The New Mexico Botanist, Issue No. 1

September 1995

Introduction

This marks the first issue of "The New Mexico Botanist." This semiannual newsletter, issued jointly by the Range Science Herbarium and the Cooperative Extension Service of New Mexico State University, is dedicated to furthering and sharing our knowledge of the New Mexico flora. It will focus on floristic and taxonomic information of interest to the botanists of the state, such as new state records, nomenclatural notes and explanations, pertinent literature, reports of inventories and theses, threatened and endangered species, announcements and reports of meetings and conferences, and the like. Additionally, I will try to maintain a "Directory of New Mexico Botanists," anticipating this will facilitate better communication and cooperation among us all.

The New Mexico Botanist is not meant to be a source of publication of original research. I recommend making use of the usual avenues of publication, which I will then try to report in the newsletter. Perhaps an exception to this would be the inclusion in The New Mexico Botanist reports of new finds in the state and distribution records of interest to the state's botanists. Obviously, I will be feeling my way a bit as we proceed.

The usefulness of The New Mexico Botanist will be greatly enhanced by you. Please send me your comments, complaints, ideas, and contributions (see "Publication and Subscription Information" on the last page). I am especially interested in those obscure inventories and reports that are published by various agencies and corporations, but whose distribution is meager. I regularly peruse the standard technical journals commonly available at a university library (Brittonia, Rhodora, Phytologia, Systematic Botany, American Journal of Botany, Great Basin Naturalist, etc.), but please send along articles from less well-known journals. Note that the Calendar section is a bit sparse; I could use some additional coming events (keep in mind we only appear twice a year). And don't be surprised if I call on you for a short article or report that I think will be of interest to us all.

This inaugural issue includes the first installment of our "Directory of New Mexico Botanists" (page 3). Many thanks to all who responded with information for the Directory. My apologies for any errors in your listing. I will maintain a running column with additions and corrections to the Directory, so please send me errata, as well as information from those of you who were not included in the first listing. The directory will be kept in a separate data base, and a corrected, comprehensive copy may be requested from me at any time.

Thank you for your interest in The New Mexico Botanist and in the flora of New Mexico
— Kelly Allred, Editor

World Wide Web and Gopher Sites of Interest to Botanists

WWW Sites of Interest to Botanists
http://meena.cc.uregina.ca/~liushus/bio/botany.html
http://biomserv.univ-lyon1fr/Ecology-WWW.html

Arizona Nature Conservancy

http://hanksville.phast.umass.edu/defs/independent/AZNC/AZlist.html

Arnold Arboretum
gopher://huh.harvard.edu/11collections_info/aa

Biodiversity and Biological Collections WWWs (Botany)
htt;://muse.bio.cornell.edu/taxonomy/botany.html

A Biologist's Guide to Internet Resources by Una R. Smith, 1993
gopher://sunsite.unc.edu/1m/../.pub/academic/biology/ecology+evolution/bioguide/bioguide.item

BIOSCI/bionet Electronic Newsgroup for Biology
http://www.bio.net/

Bishop Museum Botany Page
http://job.hcc.hawaii.edu:8080/bishop/botany/botany.html

Botany Department, University of Georgia
http://dogwood.botany.uga.edu/

California State University Stanislaus Botany 3700 Home Page
http://130.17.2.215/

Connecticut College Herbarium
http://herbarium.conncoll.edu/

Detailed Family Descriptions
http://florawww.eeb.uconn.edu/FAM_DESC_fdlist.htm

Flora of North America
http://atg1.wustl.edu/FNA/

Gray Card Index
gopher://huh.harvard.edu:70/11/project_information/authority/botany/gray_cards

The Intermountain Herbarium, Utah State University
http://www.biology.usu.edu/biology/plant.html

International Organization for Plant Information
http://life.anu.edu.au/biodiversity/iopi/iopi.html

Lythraceae, The Loostrifes
http://simon.kent.edu/Biology/SGraham.html

Missouri Botanical Garden
http://mobot.org/MoBot/welcome.html

Montana Natural Heritage Program
http://nris.msl.mt.gov/mtnhp/nhp-dir.html

National Biological Service (NBS)

http://www.its.nbs.gov/nbs/

Oklahoma Museum of Natural History (Oklahoma Biological Survey)
http://obssun02.uoknor.edu/omnh/home.html

Oklahoma Natural Heritage Inventory
http://obssun02.uoknor.edu/biosurvey/onhi/home.html

Organismic & Evolutionary Biology, Harvard university (links to herbarium and arboretum gopher servers)
http://oeb.harvard.edu/

Plant Resources Information Laboratory
http://lib-www.ucr.edu/gomez-pompa/

SMASCH Project
http://www.calacademy.org/smasch.html

Smithsonian Natural History, Department of Botany
http:/nmnhwww.si.edu/departments/botany.html

TAXACOM List Serve Archives
http://muse.bio.cornell.edu/archive/taxacom.html

Texas A&M University, Plant Taxonomy
http://www.isc.tamu.edu/FLORA/tfphome1.html

Texas Threatened and Endangered Species
http://is.rice.edu/~shel/Herp/tx.endangered.html

TROPICOS via Remote Managing Gigabytes
http://keck.tamu.edu/cgiMG/wwwRMG.mobot.html

University of Delaware Botanic Gardens
gopher://bluehen.ags.udel.edu:71/hh/.botanic_garden/botanicg.html

University of Florida Herbarium (FLAS)
http://nabalu.flas.ufl.edu/flashome.html

University of Guelph, Botany Department
http://www.uoguelph.ca/CBS/Botany/botany.htm

University of Toronto Botany Server
http://www.botany.utoronto.ca/

University of Wisconsin, Botany Gopher
gopher://gopher.adp.wisc.edu:3000/7?botany

Vatican Exhibit - Herbals
http://www.ncsa.uiuc.edu/SDG/Experimental/vatican.exhibit/exhitit/g-nature/Botany.html

Literature Reports

Allred, K.W. 1994. A new name for Aristida hamulosa (Gramineae). Phytologia 7(5):411-413.

Anderson, L.C. 1995. The Chrysothamnus-Ericameria connection (Asteraceae). Great Basin Naturalist 55(1):84-88. [Completes the submergence of Chrysothamnus into Ericameria; see Nesom & Baird 1993.]

Barkworth, M.E. 1993. North American Stipeae (Gramineae): Taxonomic changes and other comments. Phytologia 74(1):1-25. [Stipa perplexa.]

Barneby, R.C. 1991. Sensitivae Censitae. Mem. N.Y. Bot. Gard. 65:1-835. [A thorough and detailed treatment of the mimosoid genera of Fabaceae s.l.]

Bierner, M.W. 1994. Submerger of Dugaldia and Plummera in Hymenoxys (Asteraceae: Heliantheae: Gaillardiinae). Sida 16(1):1-8. [Completes the transfer of much of the old Helenium to Hymenoxys.]

Chinnappa, C.C. 1992. Stellaria porsildii, sp. nov., a new member of the S. longipes complex (Caryophyllaceae). Syst. Bot. 17(1):29-32.

Dorn, R.D. 1995. A taxonomic study of Salix section Cordatae subsection Luteae (Salicaceae). Brittonia 47:160-174. [See also Dorn's earlier Willows of the Rocky Mountain States. Rhodora 79:390-429. 1977.]

Fryxell, P.A. 1994. Malvaceae. J. Ariz.-Nev. Acad. Sci. 27(2):222-236. [Gives an up-to-date accounting of southwestern Malvaceae, excluding Sphaeralcea.]

Grimes, J.W. 1990. A revision of the New World species of Psoraleae (Leguminosae: Papiloinoideae). Mem. N.Y. Bot. Gard. 61:1-113.

Hess, W.J. and R.C. Sivinski. 1995. A new species of Zigadenus (Liliaceae) from New Mexico, with additional comments on the section Anticlea. Sida 16(3):389-400. [Zigadenus mogollonensis.]

Jones, S.D., C.T. Bryson, and J.E. Ubelaker. 1993. Carex blanda and Kyllinga odorata (Cyperaceae) new to New Mexico and a significant range extension of Cyperus retrorsus. Sida 15(3):552-553.

Jones, S.D. and G.D. Jones. 1993. Cyperus setigerus (Cyperaceae) new for New Mexico. Sida 15 (4):655-656.

Ladyman, J.A.R. 1995. Status assessment of Trifolium longipes ssp. neurophyllum. New Mexico Natural Heritage Program, Albuquerque.

Kartesz, J.T. and K.N. Gandhi. 1995. Nomenclatural notes for the North American flora. XIV. Phytologia 78(1):1-17. [Sporobolus compositus replaces S. aspera.]

Kearns, D.M. 1994. The genus Ibervillea (Cucurbitaceae): An enumeration of the species and two new combinations. Madrono 41(1):13-22.

Knight, P.J. and A.C. Cully. 1991. A new species of Astragalus (Fabaceae) from southeastern New Mexico. Southw. Naturalist 36(2):198-200. [Astragalus kerrii]

Lowrey, T.K. and P.J. Knight. 1994. Townsendia gypsophila (Compositae: Astereae): a new species from northern New Mexico. Brittonia 46:194-199.

Matthews, J.F., D.W. Ketron, and S.F. Zane. 1992. The reevaluation of Portulaca pilosa and P. mundula (Portulaceae). Sida 15:71-89. [Reaffirming the submergence of Portulaca mundula.]

Mayfield, M.H. 1993. New combinations in Chamaesyce A. Gray (Euphorbiaceae) from Texas and the Chihuahuan Desert. Phytologia 75(2):178-183.

McDonald, C. ed. 1995. Endangered plants notes and news. Number 1. U.S. Fish and Wildlife Service, N.M. Ecological Services State Office, 2105 Osuna NE, Albuquerque, NM 87113. [An "irregularly published series of notes" on endangered plant species. This issue includes notes on Trifolium longipes, a sensitive plant survey in the Jemez Mts, various projects on Sclerocactus, Astragalus, Echinocereus, Pediocactus, Cirsium, Helianthus, Ipomopsis, and Puccinellia, and reports on category updates.]

McIntosh, L. 1994. First report of Castilleja ornata (Scrophulariaceae) from the United States. Phytologia 76:329-332.

McKinney, L.E. 1992. A taxonomic revision of the acaulescent blue violets (Viola) of North America. Sida, Bot. Misc. 7:1-60.

Nesom, G.L. 1990. Taxonomic summary of Ericameria (Asteraceae: Astereae), with the inclusion of Haplopappus sects. Macronema and Asiris. Phytologia 68(2):144-155.

Nesom, G.L. 1990. Taxonomy of the genus Laennecia (Asteraceae: Astereae). Phytologia 68(3):205-228.

Nesom, G.L. 1990. Studies in the systematics of Mexican and Texas Grindelia (Asteraceae: Astereae). Phytologia 68(4):303-332.

Nesom, G.L. 1990. Taxonomy of Erigeron bellidiastrum (Asteraceae: Astereae), with a new variety. Phytologia 69(3):163-168. [Var. arenarius.]

Nesom, G.L. 1991. Taxonomy of Isocoma (Compositae: Astereae). Phytologia 70:69-114.

Nesom, G.L. 1991. A new species of Erigeron (Asteraceae: Astereae) from northwestern New Mexico. Phytologia 71(5):416-419. [Erigeron sivinskii.]

Nesom, G.L. 1994 [1995]. Review of the taxonomy of Aster sensu lato (Asteraceae: Astereae), emphasizing the New World species. Phytologia 77(3):141-297. [A somewhat controversial treatment of the genus Aster, which restricts the genus to the Old World, leaving our species in the genera Symphyotrichum, Eurybia, Almutaster, and Chloracantha.]

Nesom, G.L. and G.I. Baird. 1993. Completion of Ericameria (Asteraceae: Astereae), diminution of Chrysothamnus. Phytologia 75(1):74-93. [Reduction of most of Chrysothamnus into Ericameria; see Anderson 1995.]

Nesom, G.L. and B. Hevron. 1995. Erigeron bistiensis (Asteraceae: Astereae): A new species from northwestern New Mexico. Madrono 42:12-18.

Nesom, G.L. and D.R. Morgan. 1990. Reinstatement of Tonestus (Asteraceae: Astereae). Phytologia 68:174-180.

Roalson, E.H., S.D. Jones, and K.W. Allred. 1995. Carex amplifolia and Carex rossii (Cyperaceae), new to New Mexico and a key to section Montanae in New Mexico. Sida 16(3):592-594.

Rollins, R.C. 1993. The Cruciferae of continental North America: Systematics of the mustard family from the Arctic to Panama. Stanford University Press, Stanford, California. Pp. 976.

Sivinski, R. 1993. Noteworthy collections (New Mexico). Madrono 40:273-274.

Sivinski, R. 1994. A review of Cryptantha fulvocanescens (Boraginaceae) with the re-evaluation of Greene's Oreocarya nitida. Madrono 41(4):243-253.

Sivinski, R. and K. Lightfoot. 1994. Status summary for the grama grass cactus (Toumeya papyracantha). U.S. Fish and Wildlife Service, Region 2 Office, Albuquerque.

Sivinski, R. and K. Lightfoot, Eds. 1995. Inventory of rare and endangered plants of New Mexico. 3rd. Ed. New Mexico Forestry and Resources Conservation Division, Misc. Publ. No. 4.

Sivinski, R., T. Lowrey, and R. Peterson. 1994. Additions to the native and adventive flora of New Mexico. Phytologia 76(6):473-479.

Spellenberg, R., L. McIntosh, and L. Brouillet. 1993. New records of angiosperms from southern New Mexico. Phytologia 75:224-230.

Todsen, T.K. 1995. Malaxis wendtii (Orchidaceae) in the United States. Sida 16(3):591. [Malaxis wendtii replaces M. ehrenbergii in N.M.]

Turner, B.L. 1994. Revisionary study of the genus Allionia (Nyctaginaceae). Phytologia 77(1):45-55.

Turner, B.L. 1995. Synopsis of the genus Onosmodium (Boraginaceae). Phytologia 78:39-60.

Turner, B.L. and T.M. Barkley. 1990 Taxonomic overview of the Senecio flaccidus complex in North America, including S. douglasii. Phytologia 68(6):51-55.

Valdes-R., J. and S.L. Hatch. 1995. Anatomical study of Erioneuron and Dasyochloa (Poaceae: Chloridoideae: Eragrostideae) in North America. Sida 16(3):413-426. [Supports recognition of Dasyochloa.]

[Various authors and dates]. Vascular plants of Arizona. J. Ariz.-Nev. Acad. Sci. Vols. 26(1), 27(2), 29(1) and continuing. [Containing treatments as they are completed of Arizona families.

Wittemore, A.T. 1994. New names in North American Myosurus (Ranunculaceae). Novon 4:77-79.

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The New Mexico Botanist, Issue No. 2

January 2, 1996

A List of Master's These and Ph.D. Dissertations from NMSU and UNM Relating to Floristics and Taxonomy

by David Bleakly,
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At least 43 theses and dissertations from New Mexico State University and University of New Mexico relating to floristics and taxonomy have been written since graduate programs began at these institutions. Many other studies dealing with vegetation, ethnobotany, reproduction, evolution, remediation, ecology, and related topics have been completed, but are not listed here. The criteria for inclusion in this list are relatively narrow. The studies must be 1) a flora of a discrete area (e.g., Columbus 1988), or 2) concerned with comparisons within or between groups of plants (e.g., Loomis 1983, Nisbet 1942), or 3) related to rare plants within the state (e.g., Burks 1994). The purposes of this list are to bring to light some of these useful and possibly unknown documents and to contribute to a future bibliography of New Mexico floristics. Copies of the theses or dissertations are found in the libraries of the respective institutions.

New Mexico State University

Burks, Kelly Adele. 1994. The effects of population size and density on the pollination biology of a threatened thistle (Cirsium vinaceum). MS Thesis.

Columbus, J. Travis. 1988. Flora of Cooke's Range, southwestern New Mexico. MS Thesis. [Luna County]

Fox, William E. 1993. A field guide to selected New Mexico locoweeds and milkvetches. MS Thesis. [19 species of toxic Astragalus and Oxytropis]

Leiva, Carlos M. 1985. A morphological comparison between Eriogonum polycladon, E. densum, and E. palmerianum, and geographic variation in E. polycladon as related to E. densum. MS Thesis.

Loomis, Lynn E. 1983. Some taxonomic and ecological relationships of New Mexico perennial snakeweeds. MS Thesis. [Gutierrezia microcephala and G. sarothrae]

Mahrt, Matthew Glenn. 1993. Multivariate analysis of geographic variation in Cymopheris (Nyctaginaceae). MS Thesis.

Metcalfe, Orrin Baylor. nd [abt 1904]. The flora of the Mesilla Valley (New Mexico). Senior Thesis.

Munson, Diana Hubert. 1963. A comparative morphology of specimens of Tagetes erecta, Tagetes patula, Tagetes lemmoni, Dyssodia acerosa, Dyssodia pentachaeta, and Pectis papposa from the southwest United States. MS Thesis.

Niles, Wesley E. 1961. A winter key to the trees and shrubs of the Chiricahua Mountains and adjacent areas of southwestern Arizona. MS Thesis.

Roalson, Eric H. 1995. A floristic inventory of the upper main Diamond Creek drainage area. MS Thesis. [Black Range, Gila National Forest, Sierra County]

Rodriguez-Tijerina, Sergio R. 1992. Taxonomy of the Mirabilis californica Gray complex (Nyctaginaceae). MS Thesis.

Soreng, Robert J. 1980. A biosystematical comparison of Poa occidentalis Vasey and Poa tracyi Vasey. MS Thesis

Standley, Paul Carpenter. [abt 1905]. A statistical study of Echinocereus polyacanthus Engelm. and its nearest allies as represented by plants growing near the Agricultural Station. Senior Thesis.

Standley, Paul Carpenter. 1909. Original papers on botanical subjects. Portion of MS Thesis?

Standley, Paul Carpenter. 1909. The Allioniaceae of the United States with notes on Mexican species. MS Thesis. [Not found in NMSU library]

Thompson, Jaime. 1991. An investigation of the biology of Cirsium vinaceum. MS Thesis.

Trent, Jonathon S. 1985. A study of morphological variability in divaricate Aristida of the southwestern United States. MS Thesis.

Wilson, James M. 1974. The comparative anatomy of the anthocarp in eight species of the Nyctaginaceae. MS Thesis.

University of New Mexico

Albrecht, Stephan L. 1971. Biochemical relationships in Astragalus and Oxytropis (Fabaceae). MS Thesis.

Barnard, Carolyn Marie. 1983. A vegetative key to the grasses of New Mexico. MS Thesis.

Bedker, Ervin Joseph. 1966. A study of the flora of the Manzano Mountains. MA Thesis. [Torrance and Bernalillo Counties]

Bleakly, David Lewis. 1994. flora and vegetation of El Malpais National Monument area, New Mexico. MS Thesis. [Cibola County]

Bobisud, Helen M. 1967. A study of the genus Phacelia in New Mexico. MS Thesis.

DeBruin, Ellen A. 1988. Vascular plants and lichens on lava and sandstone substrates in Cibola County, New Mexico. MS Thesis.

Fletcher, Reggie A. 1978. A floristic assessment of the Datil Mountains. MS Thesis.

Garcia, John D. 1970. A study of the genus Potentilla in New Mexico. MS Thesis.

Krehoff, Raymond C. 1971. A monographic study of the genus Aristida in New Mexico. MS Thesis.

Mackay, Harold A. 1970. A comparative floristic study of the Rio Hondo Canyon-Lake Fork-Wheeler Peak locale, New Mexico and the Huerfano River-Blanco Peak locale, Colorado. Ph.D. Dissertation.

Manthey, G. Thomas. 1977. A floristic analysis of the Sevilleta Wildlife Refuge and Ladron Mountains. MS Thesis.

Marshall, Walter W. 1958. A distributional and taxonomic study of Ratibida columnifera var. columnifera, Ratibida columnifera var. pulcherrima, and their hybrids in New Mexico. MS Thesis.

Mexal, John G. 1971. Investigations of biochemical relationships in New Mexico Ribes (Saxifragaceae). MS Thesis.

Nisbet, Gladys Turner. 1942. A study of the genus Penstemon in New Mexico. MS Thesis.

Olsen, Mary Carol. 1965. A systematic study of the genus Castilleja in New Mexico. MS Thesis.

Osborn, Neal L. 1962. The flora of Mount Taylor. MS Thesis.

Osborn, Neal L. 1966. A comparative floristic study of Mount Taylor and Redondo Peak, New Mexico. Ph.D. Dissertation.

Riffle, Nancy L. 1973. The flora of Mount Sedgwick and vicinity. MS Thesis. [Zuni Mts, Cibola and McKinley Counties]

Robertson, Charles W. 1968. A study of the flora of the Cochiti and Bland Canyons of the Jemez Mountains. MS Thesis.

Rominger, James McDonald. 1955. Contributions to the Gramineae of Bernalillo County, New Mexico. MS Thesis.

Simms, Horace R. 1962. A floristic study of the Basidiomycetes of the Sandia Mountains, New Mexico. MS Thesis.

Tatschl, Annehara K. 1966. A floristic study of the San Pedro parks wild area, Rio Arriba County, New Mexico. MS Thesis.

Torres, Andrew Marion. 1958. A cytotaxonomic study of New Mexico Thelesperma. MS Thesis.

Von Loh, James Duwayne. 1977. A flora of the San Andres National Wildlife Refuge, Dona Ana County, New Mexico. MS Thesis.

Wagner, Warren L. 1977. Floristic affinities of Animas Mountains, southwestern New Mexico. MS Thesis.

Herbaria of New Mexico

by Carolyn Dodson
[reprinted from Madrono 37(4):311-313. 1990. Used with permission.]

One of the last states to be explored botanically, New Mexico's first plant specimens were collected in the 1830s (McKelvey, Botanical exploration of the Trans-Mississippi West, 1955). Poorly explored areas still exist in the state.

Moreover, the present size of herbarium collections in New Mexico is markedly smaller than that of neighboring states, in spite of the great diversity in topography and the complex floristic composition of the state. The combined number of specimens in the two largest collections in New Mexico is 158,000, compared with 425,000 specimens in the largest two collections in Arizona, 485,000 in Colorado and 1,272,000 in Texas (Holmgren et al., Index herbariorum part I: The herbaria of the world. 7th ed. 1981). The paucity of study specimens increases the probability that small local collections may well contain forms not found in the larger collections. This directory is compiled to inform students of New Mexico botany of the smaller, local collections available in the state.

Data for this list were collected from questionnaires mailed to 60 institutions including colleges and universities, national parks and monuments, national wildlife refuges, selected museums, and BLM district offices. Telephone calls were made to non-responders and a few herbaria were visited. From the results, 20 collections were judged appropriate for listing. Collections of less than 200 specimens, and those without data for specimens are not included. Six of the collections have Index Herbariorum standard acronyms; most of the rest probably will never be accessible in the Index. The data for the 20 collections are current as of December 1989. Although I am reasonably certain that this list is complete, I would appreciate hearing of other herbaria for inclusion in an updated list.

The largest collection, at the University of New Mexico, has 100,000 specimens. Next in size is New Mexico State University with 58,000 specimens. Eleven hold between 1000 and 15,000; seven contain less than 1000 specimens.

In 1888 the first herbarium in the state was established, at the State University of New Mexico at Las Cruces. It was the only collection in New Mexico until the 1920s, when the University of New Mexico, Cibola National Forest, and Carlsbad National Park set up herbaria.

Abbreviations used are: No. = number of specimens in the collection; Spec. = specializations of the collections; Imp. coll. = important collections and collectors; Cur. res. = current research at the herbarium.

Alamogordo

White Sands National Monument — P.O. Box 458, Alamogordo, 88310. (505)479-6124. Curator: John A Mangimeli. No.: 200. Spec.: Vascular plants of the White Sands National Monument.

Albuquerque

Bureau of Land Management — 435 Montano NE, Albuquerque, 87101. (505)761-4504. Curator: Dwain W. Vincent. No.: 570. Spec.: Compositae, Cactaceae, Leguminosae. Imp. coll.: Sclerocactus mesaverdae, Pediocactus knowltonii, Sclerocactus whipplei, Pediocactus (Toumeya) papyracantha. Cur. res.: Range of Abronia bigelovii on the Todilto Formation, clearances for proposed gypsum mining.

Cibola National Forest Herbarium — 10308 Candelaria NE, Albuquerque, 87112. (505)275-5207. Curator: Fritz Winter. No.: 300. Spec.: Flora of the Cibola National Forest.

Forest Service Herbarium, Southwestern Region — USDA Forest Service, 517 Gold Avenue SW, Albuquerque, 87102. (505)842-3228. Curator: Renee Galeano-Popp. No.: 10,000. Spec.: Flora of

Arizona and New Mexico. Imp. coll.: Threatened and endangered species. Cur. res.: Status of rare species.

Rocky Mountain Forest and Range Experiment Station Herbarium (ALBU) — 2205 Columbia SE, Albuquerque, 87106. (505)766-2384. Curator: Deborah Hays. No.: 1368. Imp. coll.: Mountain grasslands collection, collected by Janet Williams, 1984.

University of New Mexico Herbarium and Museum of Botany (UNM) — Museum of Southwestern Biology, Department of Biology, University of New Mexico, Albuquerque, 87131. (505)277-5330. Curator: Timothy Lowrey. No.: 100,000. Spec.: New Mexico and surrounding areas. Imp. coll.: Cacti - E.F. Castetter; Prince Pearce. Grasses - E.F. Castetter; W.C. Martin; R. Fletcher; L.D. Potter; W. Springfield. General collections - E.F. Castetter; H. Dittmer; L.D. Potter; W.C. Martin; R. Fletcher; P. Knight; C.R. Hutchins; Aven Nelson; Dunn and Lint; Los Medanos (WIPP). Cur. res.: Floristics of New Mexico; Ethnobotany; Biochemical Taxonomy; Distribution.

Carlsbad

Carlsbad Caverns National Park Herbarium — National Park Service, Drawer T, Carlsbad, 88220. (505) 885-8884. Curator: John E. Roth. No.: 700. Spec.: Guadalupe Mountains, including the large numbers of endemics located there. Imp. coll.: Prasil, 1952; Hewitt-McClelland, 1956; McCrary, 1952; Spangle, 1960. Cur. res.: Floritics list and coverage of species found within the Park's legal boundaries.

Farmington

San Juan College Herbarium (NMSJ) — 4601 College Blvd., Farmington, 87401. (505)326-3311 ext 358. Curator: Kenneth D. Heil. No.: 12,000. Spec.: Four Corner Region, Baja Calif., Big Bend Region, TX, SE Utah; Colorado alpine. Imp. coll.: Astragalus, Atriplex, Cactaceae. Cur. res.: Cactaceae, Eriogonum, Gilia.

Las Cruces

Bureau of Land Management Herbarium — 1800 Marquess, Las Cruces, 88005. (505)525-8228. Curator: Laird McIntosh. No.: 500. Spec.: Poaceae, Astragalus, Asteraceae. Imp. coll.: McIntosh, Sivinski, Spellenberg.

New Mexico State University Herbarium (NMC) — Biology Department, New Mexico State University, Las Cruces, 88003. (505)646-3121. Curator: Richard Spellenberg. No.: 58,000. Spec.: New Mexico and northern Mexico. Imp. coll.: Wooton, Standley, Spellenberg. Cur. res.: Floristics of New Mexico and northern Mexico, systematics of Nyctaginaceae, Astragalus, Poaceae, Quercus.

Range Science Herbarium (NMCR) — Knox Hall, New Mexico State University, Las Cruces, 88003. (505)646-1042. Curator: Kelly W. Allred. No.: 15,000. Spec.: Grasses of New Mexico, teaching specimens. Cur. res.: Grasses of New Mexico.

Las Vegas

New Mexico Highlands University Herbarium — Division of Science and Math, Las Vegas, 87701. (505)425-7511 ext 264. Curator: Maureen Romine. No.: 1000. Spec.: Southwestern plants. Imp. coll.: Lora M. Shields. Cur. res.: Plants of northeastern N.M.

Los Alamos

Bandelier National Monument Herbarium — Bandelier National Monument, Los Alamos, 87544. (505) 672-3861. Curator: Ken Stephens. No.: 2200. Spec.: Reference collection and vouchers to document the plant life of Bandelier. Imp. coll.: Clark (1941), Brian F. Jacobs (1986-88). Cur. res.: Plant inventory (1986-88).

Portales

Natural History Museum Herbarium — Eastern New Mexico University, Portales, 88130. (505)562-2723. Curator: A.L. Gennaro. No.: 6000. Spec.: New Mexican Llano Estacado. Imp. coll.: David Yos, Mary Sublette, Jack Secor. Cur. res.: Llano Estacado.

Santa Fe

New Mexico Natural History Institute Herbarium — St. John's College, Santa Fe, 87501-4599. (505) 982-3691. Curator: Roger S. Peterson. No.: 4500. Spec.: New Mexico, esp. Santa Fe, San Juan and Chaves counties; alpine tundra; Astragalus of AZ, NV, CA. Cur. res.: Ecological field projects involving NM alpine tundra, and Bitter Lake and Bosque del Apache National Wildlife Refuges.

Silver City

Department of Natural Science Herbarium (SNM) — Western New Mexico university, Silver City, 88061. (505)538-6423. Curator: Terry Heiner. No.: 6000. Spec.: Southwestern NM.

Gila National Forest Herbarium — USDA Forest Service, Silver City, 88061. (505)388-8201. Curator: John Baldwin. No.: 700. Spec.: Local common species of grasses, forbs, and shrubs of southwestern NM, used primarily as a reference for plant identification.

Socorro

Bosque del Apache National Wildlife Refuge Herbarium — Fish and Wildlife Service, P.O. Box 1246, Socorro, 87801. (505)835-1828. Curator: John Taylor. No.: 500. Spec.: Plants collected from the Refuge. Cur. res.: Plant frequency and density; centers around alkaline areas.

Bureau of Land Management, Socorro, Herbarium — 198 Neel Ave., Socorro, 87801. (505)835-0412. Curator: Wes Anderson. No.: 1848. Spec.: Plants of Socorro and Catron Counties. Cur. res.: Threatened and endangered plant inventories, in cooperation with The Nature Conservancy, on Amsonia and Erigeron rhizomatus.

New Plant Distribution Records

New records for New Mexico are documented by the county of occurrence and the disposition of a specimen (herbarium acronym).

— From Tom Todsen (2000 Rose Lane, Las Cruces, NM 88005
Diodia teres Walt. var. *setifera* Fern. (Rubiaceae): Hidalgo County (NMC)
Erythronium grandiflorum Pursh (Liliaceae): Rio Arriba County (NMC)

— From Jack Carter (P.O. Box 1244, Silver City, NM 88062) and Charles Huff (P.O. Box 1595, Silver City, NM 88062)
Abutilon incanum (Link) Sweet subsp. *pringlei* (Hochr.) Felger & Lowe (Malvaceae): Luna County (SNM,UNM).

— From Robert Dorn (P.O. Box 1471, Cheyenne, WY 82003)
Salix arizonica Dorn (Salicaceae): Taos County (Dorn Personal Herbarium).
Salix brachycarpa Nutt (Salicaceae).: Taos County (Dorn Personal Herbarium).

— Allred & Valdes-R. (1995; see literature reports)
Aristida purpurea Nutt. var. *perplexa* Allred & Valdes-R. (Gramineae): several NM counties (NMC,NMCR).

— Heil & Porter (1994; see literature reports):
Sclerocactus cloveriae Heil & Porter subsp. *brackii* Heil & Porter (Cactaceae): San Juan County (SJNM).

— Hess & Sivinski (1995; see literature reports)
Zygadenus mogollonensis Hess & Sivinski (Liliaceae): Catron County (NMC,UNM).

— Nesom (1995; see literature reports):
Chaptalia texana Greene (Asteraceae): Dona Ana County (MO,NY,US).

— Enquist & Crozier (1995; see literature reports)
Anemone tuberosa Rydb. var. *texana* Enquist & Crozier: Eddy County (TEX-LL).

Literature Reports

Taxonomy and Floristics

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Botanic Gardens, Kew, Richmond, Surrey, UK. ISBN 0-947643-79-6]

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Dressler, R.L. 1993. Phylogeny and classification of the orchid family. Dioscorides Press, Portland, Oregon. [Redefinition of Habenaria and Platanthera.]

Enquist, M. & B. Crozier. 1995. Anemone tuberosa (Ranunculaceae) from Texas. Phytologia 78 (6):428-445. [var. texana in Eddy County.]

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Compositae Newsletter. [Bertil Nordenstam, Dept. of Phanerogamic Botany, Box 50007, S-104 05 Stockholm, Sweden. Subscription gratis.]

Cyperaceae Newsletter. [P. Goetghebeur & D.A. Simpson, eds, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AB, England. Subscription $8 (cash only).]

Journal of the Southwest 37(2). 1995. [This entire issue is devoted to the Explorations on the Rio Mayo, in Sonora, Mexico, centered around the early work of Howard Scott Gentry. A must for Gentryophiles.]

The Kew Record of Taxonomic Literature. Royal Botanic Gardens, Kew. London: HMSO. [Reports of taxonomic literature of the world, organized by family, region, and discipline.]

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The New Mexico Botanist

Issue Number 3, August 1996

Forgetting, an essay

by David Ehrenfeld
[reprinted from Orion Magazine, Autumn 1989. Used by permission.]

The tragedy aboard the battleship Iowa is still in the newspaper as I start to write this letter, but it is probably the last day that it will be on the front page of the New York Times. This morning's article was about fixing the damaged gun turret--the commander of the ship says it will be difficult and might turn out to be impossible. The Iowa is of World War II vintage and the materials and technological know-how to repair its gigantic guns may not exist anymore.

There was a similar problem about ten years ago when church officials decided it was time to resume construction of New York's vast Cathedral of St. John the Divine, after a lapse of decades. It turned out that a few old men in England were the only stonemasons left in the world who knew how to work the giant blocks from which a cathedral is built. If they hadn't been able to train young apprentices, there would have been no choice but to abandon the project in a few years.

I think that our concept of progress prevents us from being aware that skills and knowledge can vanish from the world. Most of us probably imagine knowledge to be cumulative: each advance is built on prior discoveries, block piled upon block in an ever-growing edifice. We don't think of the blocks underneath as crumbling away or, worse yet, simply vanishing. Our world view doesn't prepare us for that.

Yet loss of knowledge and skills is now a big problem in our universities, and no subject is in greater danger of disappearing than our long-accumulated knowledge of the natural world. The problem is so serious that I don't hesitate to call it the next environmental crisis, although it will never rival the hole in the ozone layer or global warming for press coverage. We are on the verge of losing our ability to tell one plant or animal from another and of forgetting how the known species interact among themselves and with their environments.

The process is gradual, and it is affecting the more prestigious, research-oriented schools first. What is happening is that certain subjects no longer have anyone to teach them, or are taught on a piecemeal basis by people from the periphery of the university or outside it altogether. "Classification of Higher Plants," "Marine Invertebrates," "Ornithology," "Mammalogy," "Cryptogams" (ferns and mosses), "Biogeography," "Comparative Physiology," "Entomology" — you may find them in the catalog, but too often with the notation alongside, "Not offered in 1989-90."

The features that distinguish lizards from snakes from crocodilians from turtles from tuataras aren't any less accepted or valid than they were twenty-five years ago, nor are they easier than they used to be to learn on your own from books without hands-on laboratory instruction, but try getting someone to teach

such a lab in most top-ranked biology departments. There is at least one Ivy League university that is even having trouble staffing a basic ecology course from the faculty of its biology department, and as I write this there is a large, land-grant university that has no limnologist (a person who studies the biology of lakes and rivers) and only one, retired plant taxonomist on its main science campus.

New students who are attracted to the study of whole plants and animals still exit, but they find themselves in a very hostile teaching environment for their kind of biology. Not surprisingly, their numbers are dwindling. It is these students who, after getting their masters and doctoral degrees, ought to be going out to teach their subjects in the nation's colleges and universities, to be taking over as older professors retire. There won't be enough new graduates to go around. Reservoirs that are not replenished soon run dry.

To prove that I am not crying wolf, I want to tell a true story. One morning last April, at eight o'clock, my phone rang. It was a former student of mine who is now a research endocrinologist at a major teaching hospital in Houston. She had an odd question: at what point in animal evolution was the hemoglobin molecule first adopted for use specifically as an oxygen carrier? it was an essential piece of information for medical research that she was planning. If I didn't know the answer (I didn't), who did?

I racked my brains to think of a contemporary biochemist or university department that could provide this answer. Nothing. All I could come up with was a book, I thought by somebody names F.A. Baldwin, that I had read when I was a student. She thanked me politely and said goodbye.

Later I went down to the basement and found the book in a box. It was An Introduction to Comparative Biochemistry, by Ernest (not F.A.) Baldwin, Cambridge University Press, 1964, fourth edition--I doubt there was a fifth. The flyleaf, I noted ruefully, indicated that this hardcover text had set me back $2.75. Much of the information my former student had wanted was in there, brilliantly written.

By coincidence, I was scheduled to lecture that afternoon to a group of biochemistry professors and graduate students. So I asked them the question I had been asked earlier. "I'm not a biochemist," I said after describing the phone call. "Tell me who is working on this sort of thing these days." They looked at one another and laughed. Nobody does comparative biochemistry anymore, they answered; at least they didn't know of anybody. There probably was nothing much more recent than Baldwin. As for the graduate students, they had never even heard of comparative biochemistry.

Gone! Not outdated. Not superseded. Not scientifically or politically controversial. Not even merely frivolous. A whole continent of important human knowledge gone, like Atlantis beneath the waves. True, we still have Ernest Baldwin's book, but this kind of knowledge needs trained, experienced people to keep it alive and to hand it on to the next generation.

At nearly all of today's research colleges and universities the teaching is being done by three kinds of "temporaries": graduate students; non tenure track researchers and scholars--mostly women--who works full-time hours for part-time pay and reduced benefits; and an assortment of experts from outside the university who free-lance courses a semester at a time. What they have in common is that they are skilled workers working for substandard wages with no job security. They tend to feel exploited and are often angry, depressed, or a mixture of the two. Some of these teachers manage to be conscientious, inspiring, and creative, but few are around for very long. Teaching, more than other professions, needs continuity.

Despite the starvation of teaching, universities are receiving and spending money as never before. Where is it going? The answer varies from school to school--at one it will be computer science, at a

second genetic engineering, at a third high-energy physics--but in all cases the money is going to hire "world class scholars" at world class salaries, and to set them up in business. At my university, world class scholars have become a kind of consumer item, like fancy computer systems, and are known, collectively, as WCSI's or wixels. They are purchased on the open market. One wixel can cost tens of millions of dollars by the time the university is finished providing the building, space-age equipment, and numerous support personnel that the wixel has been promised. Wixels don't have time to teach, not even graduate students.

Eventually, every asset that the administrators can lay hands on is hocked to pay for these wixels. Teaching budgets are slashed, teaching laboratories are converted into research space, and the salaries of professors who were foolish enough to teach or whose research is not in one of the glamorous areas are seized when these professors retire or, if untenured, inevitably fail to gain promotion. Soon, all the university can afford to help keep its teaching program afloat is a flock of temporaries. Not only are they cheap, but if they complain they can be fired.

Conventional logic would have it that killing the roots and trunk of the tree to support a few exotic flowers makes no sense. What has driven higher education into this unstable imbalance? The motive, as my readers have surely guessed, is money.

Before the Second World War, universities were run by a rather small cadre of scholars-turned-administrators, usually distinguished professors who had reached a point in their careers when pomp and affluence were more appealing than the library or laboratory. This was harmless--even useful. Every university needs a royal family to get money and charm the public. But after the war, things began to change. The Managerial Revolution was upon us, university administration became a career in itself (especially for those whose academic work wasn't going anywhere), and administrators proliferated like weeds in a garden. By the seventies and eighties, control of most universities had shifted from faculty to administration, and the ranks of administrators had grown by five- or ten-fold or more. Where did the money for expansion come from?

The money came from the overhead on research grants--a postwar phenomenon--and from patents. Overhead, the amount charge by the university to administer grants, was like manna from heaven. Real administrative costs of grants are only a few percent of the total, but administrators soon discovered that they could bump the figure up 60, 70, or even more than 100 percent of the actual research request without protest from the federal granting agencies. Better yet, the money disappeared into an administrative black hole--even the researchers who obtained the grants couldn't find out what happened to the overhead. Patent income was much the same.

There was only one catch. Grants and patents are not fixed budget items. A bloated administration required more and more of these unregulated funds to support its growth, but grants and patents are undependable. Inevitably, universities began to bid against one another to attract those scientists (the wixels) who had the best records of getting large grants. Research priorities shifted to a few areas, such as genetic engineering, with the greatest cash flow from government and industry. Everything else, traditional research, innovative speculative research, and of course teaching, was sacrificed.

University administrators now find themselves on a treadmill that they can't get off. They must spend fortunes to gain fortunes, but they hardly ever gain as much as they spend. Student tuitions are raised and raised, "unproductive" departments are closed, budgets (except the wixels') are pared. Many universities, despite massive endowments and cash flows, are now little more than shells. The system is spiraling out of control.

Because similar processes are occurring throughout our society---from hospitals to secondary schools to the Department of Defense---and because we have squandered most of the natural resources that gave us our wealth, we will soon run out of money to support the Managerial University, and it will end. But abrupt, unplanned endings means chaos, which nobody wants.

How can we brake the administrative juggernaut before it crashes? This is one of the major unsolved problems confronting our precariously elaborate and interlinked society. The only solution that I can think of starts by drastically reducing the flow of money to administration---soon. There is no reason why unspecified grant overheads should exceed 8 or 10 percent. In the case of heavily endowed schools, there should also be an end to knee-jerk giving by wealthy alumni, especially contributions for new buildings. In the modern university, money is increasingly proving to be a corrosive substance.

Turning off the money tap is not enough, however. An informed public will have to demand cuts in administration, greater faculty and student influence, a tuition freeze, a moratorium on construction of "high tech" facilities, a higher priority for teaching, and support for a diversity of low-cost research projects which can function without multimillion-dollar grants and which may not generate lucrative patents.

And if there is no effective change, what then? Then we can expect the managerial ethic to continue to prevail and teaching to become vestigial as the existing university structure falls further into disarray. True, a new kind of university may emerge, perhaps already is emerging. It will have some positive features. But whatever its virtues, it will not be capable of transmitting our assembled knowledge of the natural world to the next generation. I fear for conservation when there is no one left in our places of learning who can tell one moth from another, no one who knows the habits of hornbills, no one to puzzle over the diversity of hawthorns.

Botanical Activities at the Range Science Herbarium (NMCR)

by Kelly W. Allred
Department of Animal & Range Sciences, New Mexico State University, Las Cruces, NM 88003

[This is the first in a series of introductions to the state's botanical institutions and their activities.]

The Range Science Herbarium (acronym NMCR) is located at Rm. 340 Knox Hall on the campus of New Mexico State University. It is administered through the Department of Animal & Range Sciences, College of Agriculture and is completely separate from the larger Biology Herbarium (NMC) in the College of Arts & Sciences.

The herbarium houses about 18,000 specimens, about half of them grasses, emphasizing the flora of New Mexico. The collection is especially rich in Aristida and Bothriochloa from western United States and northern Mexico.

Staff at the herbarium is small: Kelly Allred (faculty, curator), one or two graduate students (currently one, Thomas Adams), and usually a student employee who helps with mounting and filing. Of course, the botanical activities of the herbarium center around the interests and capacity of the curator and graduate students.

Teaching-Related Activities: In addition to its courses in agriculture, the Department of Animal & Range Sciences offers some botanically-related courses, which are taught by Allred. Range Grasses and Range Plants emphasize recognition and identification of southwestern plants and are taught every

semester. Other botanical courses are offered periodically: Botanical Latin & Nomenclature, Advanced Grass Systematics. The herbarium staff also trains the Range Plant Identification Team, which competes in an annual plant identification contest sponsored by the Society for Range Management at its annual meeting.

Research-Related Activities: A long-term project at the herbarium is maintaining the Working Index of New Mexico Vascular Plant Names. This is a computer text file of all the scientific names used for New Mexico plants. The names are arranged by family within the larger categories of Ferns and Fern Allies, Dicotyledonous Plants, and Monocotyledonous Plants. The listing is meant to be updated and corrected in order to provide to the state's botanists a current list of the plants of the state. As correct names and classifications change, pertinent synonyms are added to the Index, as well as literature references documenting the changes. The Working Index currently encompasses 254 printed pages and 38 pages of supplements.

Another long-term and on-going project is the study of the Grasses of New Mexico. The little booklet, A Field Guide to the Grasses of New Mexico, summarizes our findings thus far. We have tried to not only document which grasses actually occur in the state, but also to verify nomenclature, investigate taxonomic problems, provide means of identification, and authenticate distributions. The current listing reports about 470 kinds of grasses (all species, subspecies, varieties, etc.) in New Mexico.

Other floristic projects include collaborating with Richard Worthington (Univ. Texas El Paso) on a Flora of the Organ Mountains (Dona Ana County) and with several other New Mexico botanists on a Flora of the Manzano and Sandia Mountains.

Recent floristic projects that have been completed were a Floristic Inventory of the Diamond Creek Drainage in the Gila National Forest (by Eric Roalson) and a Flora of Cooke's Range in Luna County (by Travis Columbus).

A new project is the inventory of the Mosses of New Mexico. The herbarium has a beginning collection of about 170 mosses from the state, and an initial draft list documents 30 families, 92 genera, and 261 species in New Mexico.

Also in the inaugural stages is an inventory of the Aquatic Plants of New Mexico. This project begins with a master's thesis (by Thomas Adams) concentrating on the southwestern six counties and focusing on only the truly aquatic plants of perennial bodies of water.

Systematic or monographic research at the herbarium focuses on the grass genus Aristida. We have studied this interesting genus throughout the United States, but have concentrated on the species occurring in the Southwest and northern Mexico, in particular the Aristida purpurea, A. pansa, A. ternipes, and A. schiedeana complexes. Earlier systematic work involved grasses in the genus Bothriochloa.

Extension-Related Activities: Because the herbarium is affiliated with the New Mexico State Cooperative Extension Service, some of our activities involve county agents, Extension Specialists, and the general populace, such as providing routine plant identifications for the citizens of the state. Also, we are involved in plant identification training of county agents and ranchers. A collaborative project with the state weed specialist, Richard Lee, is the production of a Manual of the Knapweeds and Starthistles of New Mexico. This project is nearing completion and will provide keys, descriptions, maps, and photographs of these often noxious weeds.

Words to Live By

"I would be converted to a religion of grass.
Sleep the winter away and rise headlong each spring.
Sink deep roots.
Conserve water.
Respect and nourish your neighbors and never let trees gain the upper hand.
Such are the tenets and dogmas.
As for the practice — Grow lush in order to be devoured or caressed, stiffen in sweet elegance, invent startling seeds — these also make sense.
Bow beneath the arm of fire.
Connect underground.
Provide.
Provide.
Be lovely and do no harm."
— Louise Erdrich
[courtesy of Roger Peterson]

New Plant Distribution Records

New records for New Mexico are documented by the county of occurrence and the disposition (herbarium) of a specimen.

— Joneen Cockman (P.O. Box 5002, University Station, Las Cruces, NM 88003)
Brickellia veronicaefolia (H.B.K.) Gray (Asteraceae): Otero County (NMCR).

— Charles Huff (1420 Corbin St., Silver City, NM 88061)
Brassica rapa L. (Brassicaceae): Catron County (SNM).
Fraxinus anomala Torr. ex S. Wats. var. lowellii (Sarg.) Little (Oleaceae): Catron County (SNM).
Phoradendron californicum Nutt. (Viscaceae): Hidalgo County (SNM). [This documents the disposition of two specimens of this rare mistletoe.]

— Mosyakin (1995; see literature reports)
Corispermum americanum (Nuttall) Nuttall var. rydbergii Mosyakin (Chenopodiaceae). ["... seems to occur in several localities in Arizona, Colorado, New Mexico, Texas, and Utah."]

— Bob Sivinski (P.O. Box 1948, Santa Fe, NM 87504-1948)
Chenopodium cycloides A. Nels. (Chenopodiaceae): DeBaca County (UNM). [Additional collections of this species.]

— Turner (1995; see literature reports)
Hedyotis nigricans (Lam.) Fosberg var. papillacea B.L. Turner (Rubiaceae): Otero County (LL).

— Endangered Plants Notes and News (1996; see literature reports)
Salix arizonica Dorn (Salicaceae): Rio Arriba County (Santa Fe Nat. For. Herbarium) [Previously reported only from Taos County.]

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Morden, C.W. 1995. A new combination in Muhlenbergia (Poaceae). Phytologia 79(1):28-30. [M. villiflora var. villosa (Swallen) Morden]

Mosyakin, S.L. 1995. New taxa of Corispermum L. (Chenopodiaceae), with preliminary comments on the taxonomy of the genus in North America. Novon 5:340-353. [Corispermum americanum var. rydbergii Mosyakin]

Nesom, G.L. 1995. Key to the American genera of Asterinae (Asteraceae). Phytologia 79(4):281-285. [The key to all those new genera proposed by Nesom in 1994]

Reveal, J.L. 1995. Subfamily names in an 1832 preprint of an article on botany for the seventh edition of the Encyclopaedia britannica. Taxon 44:589-596.

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U.S. Fish & Wildlife Service, Federal Register, Vol. 61, No. 116:30209-30212. Proposal to remove Echinocereus lloydii from the Federal list of endangered and threatened plants. [Copy available from U.S.F.W.S., 2105 Road, NE, Albuquerque, NM 87113]

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The New Mexico Botanist

Issue Number 4, December 11, 1996

Botanical Activities at UNM Herbarium

Botanical Activities at The University of New Mexico Herbarium (UNM)

by Jane Mygatt Department of Biology, University of New Mexico, Albuquerque, NM 87131

The UNM Herbarium (acronym UNM) is a division of the Museum of Southwestern Biology which is housed in the Department of Biology at the University of New Mexico. The herbarium was established in 1928 with the arrival of Edward F. Castetter, professor and chair of the Department of Biology. When Castetter arrived, there was a small collection of approximately 150 mounted specimens, mostly collected by E.O. Wooton, P.C. Standley and O.B. Metcalfe. Between 1928 and 1953, Castetter developed the herbarium in addition to conducting a series of studies in ethnobotany. Ray C. Jackson (curator from 1953-1958) worked in areas of cytogenetics and systematics. William C. Martin, during his term as curator (1958-1989) co-authored "A Flora of New Mexico". Since 1990, Timothy K. Lowrey has been curator while conducting biosystematic research on the Asteraceae. The herbarium contains more than 92,000 mounted specimens, providing researchers and students with a thorough representation of the floristic diversity in New Mexico and the Southwest. The majority of the division's holdings consist of flowering plants from the Southwest, with an emphasis on the vascular plants of New Mexico. Among the important collections are the Cactaceae, with more than 2,500 specimens. The herbarium also houses a seed, lichen, moss and teaching collection, in addition to a type collection of 125 specimens. The herbarium is the repository for voucher specimens of threatened and endangered plants collected by botanists from the New Mexico Heritage Program and the New Mexico State Forestry Department. Herbarium staff maintain a number of resources available on the World Wide Web, including the UNM Herbarium's home page and the Carnivorous Plant Archive (for the International Carnivorous Plant Society). Other resources developed by herbarium staff and available on the UNM Herbarium home page include directories containing e-mail and mailing addresses for Plant Taxonomists (PTO), Herbaria (HOL) and Collection Managers (CMO) throughout the world. The UNM Herbarium home page URL address is: http://biology.unm.edu/~herb/. The Museum of Southwestern Biology has outgrown its space and recently acquired a new location adjacent to the Department of Biology. Renovation is scheduled, and the herbarium and other divisions of the Museum of Southwestern Biology will relocate within the next two years. The renovated facility will be equipped with compactors to accommodate the projected growth of each division for a minimum of 20 years. UNM Research Activities Herbarium staff and student research focuses on floristic research in New Mexico, genetic diversity analyses of rare and endangered plants, biosystematic and molecular systematic studies of vascular plants in the Pacific Basin including Oceania and Australasia, and evolutionary genetics of adaptive radiation in the Asteraceae. Tim Lowrey's research focuses on biosystematic and molecular studies of the Asteraceae, particularly on Tetramolopium and related genera in Australasia and the Pacific. Currently, Tim is involved in a number of studies, including evolutionary genetics of adaptive radiation in Tetramolopium (with R. Whitkus, UC Riverside), molecular systematics of Tetramolopium and Vittadinia (with C. Quinn, University of New South Wales), genetic diversity of Larrea in the Chihuahuan Desert, flora of the Sandia and Manzano

Mountains, and biosystematic studies of Townsendia. Patricia Barlow's dissertation research involves the taxonomy of the Cirsium arizonicum complex (sensu Moore & Frankton). Despite the Arizona name, this group of thistles also grow in Colorado, Utah, Nevada, Texas, and New Mexico. This group is united by narrow capitula and short styles, which may be an adaptation to hummingbird pollination. Patricia's primary evolutionary question concerns the cause and maintenance of species complexes in nature. Chris Frazier has worked on conservation and community ecology of the chaparral, coastal sage scrub and vernal pool habitats in southern California. His dissertation research focuses on the ecological and evolutionary significance of natural hybridization. Currently, Chris is looking at the relationship between hybridization, reproductive biology and ecological specialization in tropical pitcher plants (Nepenthes). His New Mexico interests include the systematics of Philadelphus and the Onagraceae. Jane Mygatt's thesis research focuses on the conservation and population genetics of the western nettle, Hesperocnide, a genus of two morphologically similar but geographically disjunct annual species. The distribution pattern is unusual in that H. tenella is prevalent throughout much of California and northern Baja California, while H. sandwicensis is reported only on the big island of Hawaii. This research will assess the amount of genetic variation between these species, while exploring the origins of, and genetic variability in H. sandwicensis, a proposed endangered species on the island of Hawaii. Steven Yanoff's thesis research will focus on the present and past vegetation and geomorphology of the Chihuahuan Desert. Steven has been an employee of the New Mexico Natural Heritage Program for the past two years and has worked on a floristic inventory, vegetation community analysis and satellite image-based vegetation map of the mountains and lowlands of the Tularosa Basin. David Bleakly, a research associate of the herbarium, is working in conjunction with a variety of researchers on "A Flora of the Sandia and Manzano Mountains." David's thesis research centered on the floristics of El Malpais National Monument. In addition to an interest in the plants of El Malpais National Monument, current projects include a guide to the common plants of the Sandia Mountains and an illustrated guide to the plant families of the Southwest.

Key to the Taxa of Cercocarpus in New Mexico

[Editor's Note: Bob Denham is generously making available prior to publication some of his findings on New Mexico species of Cercocarpus. No new taxa or nomenclatural combinations are formally proposed herein, but anticipated novelties are indicated as "var. nov. in prep." and will be officially described in a later publication.]

KEY TO THE TAXA OF CERCOCARPUS (MOUNTAIN MAHOGANY) IN NEW MEXICO

by Robert A. Denham 3609 W. Jasmine, Las Cruces, NM 88005

The author and James Henrickson (California State University at Los Angeles) have undertaken a revision of the genus Cercocarpus (Rosaceae), the first parts of which have been completed and are to be published shortly. This article for the "New Mexico Botanist" presents a key, excerpted and adapted from future publications, to the taxa which occur in New Mexico; five such taxa are recognized, four of which are common here. The fifth, Cercocarpus intricatus, more widespread in Utah and Nevada, has been collected in this state at only one location in San Juan County. The New Mexico distributions of the other four taxa generally coincide with the floristic provinces outlined in the introduction of Martin & Hutchins' "New Mexico Flora". Thus, we have a Chihuahuan taxon, C. breviflorus var. breviflorus; a Mogollon taxon, C. breviflorus var. nov. in prep.; a Great Plains taxon, C. montanus var. argenteus; and a taxon spanning the Rocky Mountain and Great Basin floristic provinces, C. montanus var. montanus. The taxon from the Mogollon floristic province, Cercocarpus breviflorus var. nov. in prep., is essentially equivalent to the entity which Kearney & Peebles (1951) refer to as C. breviflorus var. eximius. However, the epithet eximius is based on material that falls within the morphological and geographical range of C. breviflorus var. breviflorus and is therefore a synonym of that taxon. Since the epithet

eximius has been misapplied to the more western variety of C. breviflorus, the publication of a new name for that variety is required; it will be named for its distribution in the Mogollon region of New Mexico and Arizona. Although the names C. paucidentatus and C. montanus var. paucidentatus have been used for New Mexico plants (Martin & Hutchins 1980, Wooton & Standley 1915), the epithet paucidentatus properly applies to a distinct third variety of C. breviflorus from San Luis Potosi and Hidalgo, Mexico, . The epithet argenteus has, at times, been misapplied to any Cercocarpus with denser than average leaf vestiture. For example, plants from the higher elevations in the Guadalupe Mts., treated as C. montanus var. argenteus in Correll & Johnston (1970), fall within the circumscription of C. montanus var. montanus. Correct to type, the combination C. montanus var. argenteus applies to a taxon whose range extends only into the northeastern part of New Mexico. When using the following key, it is important to keep in mind several trends in the vegetative variability of Cercocarpus in response to environmental factors. Leaves from plants in mesic and/or shaded situations are longer and proportionately broader than the norm. Leaves on long-shoots are usually longer and proportionately narrower than those on short-shoots. Leaves on drought-stressed individuals are small and relatively broad. The vestiture of the long-shoots is often more spreading than that of the mature growth. No hybridization between species has been observed in New Mexico, except possibly for one specimen from Lincoln County; where sympatric, species are elevationally segregated. Earlier reports of extensive hybridization in Cercocarpus (F. Martin 1950) have been the result of attributing variation in leaf size, shape and dentition to hybridization rather than to environmental factors. In general, Cercocarpus montanus can be distinguished from C. breviflorus by its thin, winter-deciduous leaves and its relatively large flowers and fruits versus the thicker, sub-coriaceous leaves and the smaller flowers and fruits of C. breviflorus. The leaves of C. montanus are also usually larger, broader and more prominently toothed than those of C. breviflorus. In this key the couplets are longer than is standard, in lieu of full descriptions.

1a. Anthers glabrous. Leaves more than 4 times as long as wide, coriaceous, with revolute margins, often resinous. [North-western corner of the state in San Juan Co.] ..... C. intricatus S. Wats.

1b. Anthers hirsute. Leaves less than 4 times as long as wide; either sub-coriaceous and evergreen, or thin and winter-deciduous. [Widely distributed throughout the state.].

2a. Leaves thin and winter-deciduous; typically ± ovate-trullate, varying to obovate-orbicular; coarsely crenate or serrate-dentate on the apical half of the leaf; usually more than 1.8 cm. long. Flowers and fruits relatively large; hypanthial tube, in fruit, 9 to 15 mm long and 1.5 to 3.0 mm wide (before splitting); fruiting hypanthium plus pedicel 12 to 20 total length, if shorter (or near the short end of the range) then the hypanthium usually 3 or more times longer than the pedicel; fruiting style 4 to 8 cm. long. [Northern 2/5 of the state; also at higher elevations from the Sandia Mts. south-southeast to the Guadalupe Mts.] ..... C. montanus Raf.

3a. Fine, curled-twisted trichomes on intercostal areas of lower leaf surface long, numerous and ± ascending-spreading; thicker, straight trichomes on primary and secondary veins of lower leaf surface antrorsely appressed; trichomes on upper leaf surface and hypanthium ± antrorsely appressed, similar to trichomes on primary and secondary veins of lower leaf surface. [Northeastern corner of the state in Union, Quay and Harding Counties; west into San Miguel Co. in the lower elevations near Las Vegas; introgressing somewhat into var. montanus as far west as the Sandia Mts.] ..... C. montanus Raf. var. argenteus (Rydb.) F.L. Martin

3b. Fine, curled-twisted trichomes on intercostal areas of lower leaf surface short, appressed, forming a dense tomentum; thicker, straight trichomes on primary and secondary veins of lower leaf surface varying from spreading to antrorsely appressed (even within populations); longer hairs sometimes also

present on intercostal areas of lower leaf surface, but when present, similar to the thicker, straight trichomes on primary and secondary veins; trichomes on upper leaf surface and hypanthium varying from spreading to antrorsely appressed, but matching the trichomes on primary and secondary veins of lower leaf surface. [Northwestern and north-central parts of the state; on the western side of the state, as far south as the Datil Mts. in northeastern Catron Co.; also at higher elevations from the Sandia Mts. south-southeast to the Guadalupe
Mts.] ..... C. montanus Raf. var. montanus

2b. Leaves moderately thick, sub-coriaceous and evergreen, although sometimes drought deciduous; usually rhombic-elliptic or cuneate-oblanceolate, sometimes obovate; entire or shallowly crenate-dentate near the leaf apex; usually less than 2.5 cm. long. Flowers and fruits relatively small; hypanthial tube, in fruit, 5 to 8 mm long and 0.7 to 2.0 mm wide (before splitting); fruiting hypanthium plus pedicel 6 to 13 mm in total length, if longer (or near the long end of the range) then the hypanthium usually 2.5 or less times longer than the pedicel; fruiting style 2.0 to 4.5 cm. long. Sometimes with spinescent branchlets. [Mostly in the southern, central and west-central parts of the state; at lower elevations when sympatric with C. montanus] ..... C. breviflorus A. Gray

4a. Leaves rhombic-elliptic or cuneate-oblanceolate; entire, or sometimes shallowly crenate-dentate near the leaf apex; upper surface pale to bright green, the translucent upper epidermis dulling the colors of the bundle sheath extensions and parenchyma tissues. Vestiture of the mature leaves and hypanthia usually appressed, rarely spreading. Hypanthium plus pedicel, in fruit, 5 to 10 mm in total length; fruiting style 2.0 to 3.5 cm. long. Shrubs, in xeric habitats 0.5 to 1.5 m. tall and intricately branched, often with spinescent or sub-spinescent branchlets; in mesic habitats to 5 m. tall, with an open irregular branching pattern and much branched from base. [Southern part of the state, from Hidalgo Co. and southern Grant Co. east to Eddy Co.; central part of the state, mostly east of the Rio Grande, as far north as Bernalillo Co.] ..... C. breviflorus A. Gray var. breviflorus

4b. Leaves usually cuneate-oblanceolate or obovate, uncommonly elliptic; typically shallowly crenate-dentate near the leaf apex or on the apical half of the leaf; upper surface of leaves dark green, the transparent upper epidermis revealing the colors of the bundle sheath extensions and parenchyma tissues. Vestiture of the mature leaves and hypanthia usually spreading, rarely appressed. Hypanthium plus pedicel, in fruit, 8 to 13 mm in total length; fruiting style 3.0 to 4.5 cm. long. Shrubs, generally 1.5 to 3 m. tall, sometimes to 6 m. tall; branches erect-ascending with sparse lateral branching; bush form narrowly obovoid-obconic or sub-columnar in the largest individuals. [Mostly in the western part of the state, from Grant Co. and western Sierra Co. north to southern McKinley Co. and Sandoval Co.; east of the Rio Grand in Santa Fe Co. and western San Miguel Co.; intergrading with var. breviflorus in Bernalillo Co. and Hidalgo Co.] ..... the Mogollon taxon, C. breviflorus A. Gray var. nov. in prep.

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Note: The third variety of Cercocarpus breviflorus, to which the epithet paucidentatus properly applies, occurs further south in San Luis Potosi and Hidalgo, Mexico.

New Plant Distribution Records

New Plant Distribution Records

New records for New Mexico are documented by the county of occurrence and the disposition (herbarium) of a specimen.

— Kelly W. Allred (Box 3-I, New Mexico State Univ., Las Cruces, NM 88003) .

Centaurea diffusa Lam. (Asteraceae): San Miguel County (NMCR).

Chloris submutica Kunth (Poaceae): Dona Ana County (NMCR). [This is the first record of this adventive species in New Mexico since 1947.]

Euphorbia peplus L. (Euphorbiaceae): Dona Ana County (NMCR).

Isatis tinctoria L. (Brassicaceae): Santa Fe County (NMCR).

— Bob Denham (3609 W. Jasmine, Las Cruces, NM 88005).

Opuntia chihuahensis Rose (Cactaceae): Luna County (UTEP). [Verification of Wooton & Standley's (Fl. New Mex.) report of this species in southern New Mexico.]

— Mosyakin (1996; see literature reports).

Salsola collina P.S. Pallas (Chenopodiaceae): unspecified occurrence in New Mexico.

— Robert Sivinski (P.O. Box 1948, Santa Fe, NM 87504).

Salix taxifolia Kunth (Salicaceae): Hidalgo County (pers. observation). [Additional record for this little known species.]

— Sivinski, et al. (1995; see literature reports).

Artemisia pygmaea A.Gray (Asteraceae): McKinley County (UNM).

Berteroa incana (L.) DC. (Brassicaceae): Sandoval County (UNM).

Cleomella palmerana M.E. Jones (Capparaceae): San Juan County (UNM).

Eleocharis bella (Piper) Svenson (Cyperaceae): Rio Arriba County (UNM).

Epilobium lactiflorum Hausskn. (Onagraceae): Taos County (UNM).

Hackelia ursina (Greene ex Gray) I.M. Johnston var. pustulosa (Macbr.) J.L. Gentry (Boraginaceae): Hidalgo County (UNM).

Huperzia lucidula (Michx.) Trev. (Lycopodiaceae): Santa Fe County (UNM).

Hypoxis hirsuta (L.) Cov. (Liliaceae): Cibola County (UNM).

Lycopodium clavatum L. (Lycopodiaceae): Sandoval County (UNM).

Malacothrix glabrata (D.C. Eat. ex A.Gray) A.Gray (Asteraceae): Hidalgo County (UNM).

Senecio amplectens A.Gray var. holmii (Greene) Harrington (Asteraceae): Taos County (UNM).

Senecio integerrimus Nutt. var. integerrimus (Asteraceae): Rio Arriba County (UNM).

Solidago speciosa Nutt. var. pallida Porter (Asteraceae): Los Alamos County (UNM).

— Richard Spellenberg (Box 3AF, New Mexico St. Univ., Las Cruces, NM 88003).

Allowissadula holosericea (Scheele) Bates (Malvaceae): Eddy County (NMCR).

Momordica balsamina L. (Cucurbitaceae): Dona Ana County (NMC).

— Victor Steinmann (Rancho Santa Ana Botanic Garden, 1500 N. College Ave., Claremont, CA 91711).

Euphorbia cyathophora Murr. (Euphorbiaceae): county unspecified (RSA).

— Gordon Tucker (New York St. Museum, 3132 CEC, Albany, NY 12230).

Cyperus strigosus L. (Cyperaceae): county unspecified (GH).

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Allred, K.W. 1996. **A working index of New Mexico plant names: Supplement 1:3.** Available from the author (Box 3-I, New Mexico St. Univ., Las Cruces, NM 88003). [Includes mosses.]

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Baldwin, B.G., D.W. Kyhos, S.N. Martens, F.C. Vasek, & B.L. Wessa. 1996. **Natural hybridization between species of *Ambrosia* and *Hymenoclea salsola* (Compositae).** Madrono 43:15-27.

Bogler, D.J. 1995. **Systematics of *Dasylirion*: taxonomy and molecular phylogeny.** Bol. Soc. Bot. Mexico 56:69-76.

Bogler, D.J. & B.B. Simpson. 1996. **Phylogeny of Agavaceae based on ITs rDNA sequence variation.** Amer. J. Bot. 83 (9):1225-1235.

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Esparza-S., S. & Y. Herrera-A. 1996. **Revision de *Bouteloua barbata* Lagasca (Poaceae: Eragrostideae).** Phytologia 80:73-91.

Farjon, A. 1996. **Biodiversity of *Pinus* (Pinaceae) in Mexico: speciation and palaeo-endemism.** Bot. J. Linn. Soc.121:365-384.

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Native Plant Society of New Mexico Newsletter. Tim McKimmie, 1105 Circle Drive, Las Cruces, NM 88005.

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The New Mexico Botanist

Issue Number 5, May 7, 1997

The NMSU Herbarium (NMC)

The NMSU Herbarium (NMCR), an Information Resource of Plant Diversity in New Mexico

by Richard Spellenberg Department of Biology, New Mexico State University, Las Cruces, NM 88003

The value of herbaria in a technological world is very poorly understood, or understood not at all, by individuals who are not associated with documenting biodiversity, its changes, or the study of relationships among plant taxa. Herbaria now have a 500 year history, plants preserved a half millennium in the past still highly usable to specialists who study them. Most herbaria in the world are far younger than that, few are older than 1.5 centuries and many are only a few decades old. All supply information on request, through visitation, or by loaning specimens to interested workers in diverse regions. They reveal patterns of diversity present and past, provide information on morphological differentiation that leads to evolutionary insight, provide raw data for taxonomic work and conservation efforts, assist in routine identification, document many studies in biodiversity throughout the recent history of a region, and may even be a repository for "preserved" molecules that will be useful in determining relationships through the use of modern molecular methods. Herbaria deserve and require excellent care. Each herbarium that has more than 5000 specimens has an international acronym. The one in the Biology Department at New Mexico State University is NMC, after the older name for the school, New Mexico College of Agricultural and Mechanic Arts.

The NMC herbarium is the oldest in the state, and is historically the richest. It began with the founding of the school and the hiring of Elmer Ottis Wooton as Professor of Chemistry and Botany in 1890. Wooton had a simultaneous appointment with the Agricultural Experiment Station as State Chemist and State Botanist. He immediately began widely collecting in the territory, extending through most portions of the present state of New Mexico, going as far as the Grand Canyon, Arizona, in 1892, and south into Juarez near the end of the century. He continued collecting in the state until he left for the Bureau of Plant Industry in Washington, DC, in 1911. During his 21 year at the school he made well over 5000 collections, and these collections formed much of the basis of the Flora of New Mexico, published in 1915. He associated with Paul Carpenter Standley, who received his master's degree at New Mexico, and whose collections from the northeastern part of the state are in NMC. The Flora was co-published with Standley, who at that time was stationed at the Smithsonian Institution.

Wooton used his duplicates from his collections to exchange with other institutions, in that manner obtaining specimens from their region or elsewhere. Many famous collectors are represented at NMC. The collection grew steadily from 0 specimens in 1890 to reportedly 18,000 by 1905, and 35,000 by the time Wooton left. For example, by exchange NMC received a set of Lindheimer's collections from 1850 from central Texas, and specimens from the early 1830's from the Pyrenees. The latter are mostly curiosities for us and as they are found are sent to herbaria that specialize in European plants.

From 1911 to 1966 the history of the herbarium is sketchy at best. During this period specimens that

were important range plants were used heavily in teaching and were heavily damaged and many perhaps even destroyed through extensive use.

By almost all standards, NMC is a small collection, now with about 62,000 specimens, the actual number quite uncertain for the following reasons. For the first 50 years specimens were accessioned without an accession number, and then in the late 1930's someone went through the herbarium from start to finish and penned on each specimen consecutive numbers. Later, perhaps in the early 50's, someone with an automatic numerator numbered those that had accumulated since the first series of numbers were penned on specimens, and then in the mid-60's a careless worker again stamped many specimens with yet another accession number. Adding to the confusion was the addition of many duplicates of a person's collection. Perhaps an assistant went into the attic of old Foster Hall, retrieved some unmounted specimens (there were about 20,000 stored up there when Spellenberg arrived in 1968), and prepared them for the herbarium. For example, O. B. Metcalfe, who collected extensively in the Black Range before 1910, preparing beautiful material, had the same species collected in the same place at the same date represented up to eight times at NMC. As such collections were found, duplicates were removed from the herbarium and sent as gifts to other institutions interested in specimens from the region. The correction of all these redundancies in numbers and specimens, in addition to the removal of specimens that are not particularly useful (from Laborador, the Pyrenees), and just plain junky specimens, all serve to reduce the number estimated by the automatic numerator (67,500).

In 1953 Wm. Dick-Peddie, a plant community ecologist, arrived at the school. He taught primarily botany and ecology, and he curated the herbarium. Specimens were added to the herbarium that were collected in the early 1950's, many by David Dunn who had left for a position in Missouri. Dr. Dick-Peddie also processed loans of NMC specimens for other institutions; there are no records of loans before that time. In the mid-1960's Don Gordon joined the staff and curated the herbarium, but he added no specimens of his own. He left in 1968 for Minnesota; Richard Spellenberg joined the Biology Department staff at that time and took over herbarium curation.

At that time the herbarium was estimated to have about 38,500 specimens. The backlog of 20,000 specimens, received on exchange by Wooton 50 years earlier and stored in the attic, were processed over a period of about five years. The majority were sent to institutions elsewhere, especially specimens that were not within the focus of an NMC growth policy that emphasized quality specimens from the Southwest and northern Mexico. Among the specimens in the attic were about 500 that were collected by Cyrus Gurnsey Pringle, a famous collector of Mexican plants from about the turn of the century. These had been stored since Wooton received them from the Smithsonian Institution. Among other jewels found in the NMC collection were specimens collected by Herrick, a president of UNM before 1910, as discussed by Robert Sivinski in the most recent Native Plant Society of New Mexico Newsletter. Herrick apparently sent plants to Wooton for identification, and Wooton incorporated them into the collection.

In 1968 the herbarium occupied a small space on the third floor of Foster Hall, where there are now offices and a plant physiology research lab. With remodeling of Foster Hall in 1971 the herbarium moved to quarters about double in size on the second floor of that building. In 1992 it was determined that the herbarium occupied prime space for a new laboratory of evolutionary and ecological genetics. It was moved to even more spacious and nicely remodeled quarters in the Biology Annex, a building constructed during World War II for air mechanics training. That move provided leverage to request a grant from the National Science Foundation for general improvement and expansion, and NMC received funds for a 20% increase in storage capacity, a state of the art dissection microscope, and some curatorial supplies. At present rates of acquisition that follows a policy of accepting only excellent material from areas of interest to New Mexico State University, NMC has several decades of growth before crowding again makes new space urgent.

NMC supports ecological and systematic research in the region, and makes the specimens available to workers throughout the world through its visitation and loan policies (about 25-30 loans made per year). Areas of interest are all of New Mexico and parts of adjoining states, and northern Mexico, especially the Chihuahuan Desert and the Sierra Madre Occidental. Plant groups of special value because of research interests are accessioned as are specimens from botanists who collect in the state for land management agencies or for special projects estimating environmental impacts of development. Excellent specimens from master's students doing floristic studies are also incorporated. In the mid-1970's a collection of plants by William Chapline from the Lincoln Forest, collected around 1915, were found in a shed in Alamogordo. These were in good shape and were processed. In the early 1990's another US Forest Service collection was discovered in a shed in Gila, and among them Chapline specimens from the Gila Forest. These two collections serve to give an excellent view of Forest Service collecting activity in southern New Mexico at that time and are now available to the scientific public.

Growth of herbaria in general has now slowed as exploration of much of the earth's biota comes to a close and political and social problems make entry into many areas difficult or dangerous. NMC continues to accession between 700-1000 specimens per year. As important is making this information stored in the collection available to anyone needing it. The personal computer and programs for data-basing now make this feasible. Data-basing of information associated with specimens is now underway at NMC (6200 entries so far), information that will eventually be available on the Web. As data-basing progresses, errors in accession numbering are being corrected, ultimately to provide a good estimate of the size of the collection.

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Craig's Juicy Native Grass Gossip & Research. P.O. Box 609, Redwood City, CA 94064, or on the internet at http://www.batnet.com/rwc-seed/juicy.gossip.one.html [Abstracts agricultural research on native grasses.]

Flora of North America Newsletter. Gratis from FNA Newsletter, Box 299, St. Louis, MO 63166-0299.

Native Plant Society of New Mexico Newsletter. Tim McKimmie, 1105 Circle Drive, Las Cruces, NM 88005.

New Plant Distribution Records

New records for New Mexico are documented by the county of occurrence and the disposition (herbarium) of a specimen.

— Robert Sivinski (P.O. Box 1948, Santa Fe, NM 87504).

Salvia texana (Scheele) Torrey (Labiatae): Eddy County (UNM).

Plantago wrightiana Dcne. (Plantaginaceae): Sierra County (NMCR).

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The New Mexico Botanist

Issue Number 6, September 4, 1997

Herbarium UTEP

by Richard D. Worthington, P.O. Box 13331, El Paso, TX 79912

The herbarium of the Centennial Museum, The University of Texas at El Paso, was founded in the 1970s from small holdings of student collections and gift material from Elsie M. Slater and John S. Williams. It was housed in the Department of Biological Sciences as part of the Museum of Arid Land Biology and the first curator was A.H. Harris (1971-1976). Shortly after its creation a SELGEM program was used to data-base the collection. Limited funding was available over the years to keep the data entry going. Significant collection growth started in the late 1970s when Richard Worthington started sampling the flora of the nearby Franklin Mountains and expanded to sampling more than 20 mountain masses in the region. Worthington became the curator in 1980, replacing Bill Reid (1976-1980). Exchange programs were started for specimens and literature. Collection growth through the 1980s and 1990s has been significant, bringing the present total count to 56,000 specimens. Regional coverage of the flora is now quite good. The old SELGEM files were converted to a modern Lotus Approach Database for Windows. The complete collection is data-based, making it easy to describe and search the collection for coverage and specific holdings. More information about the herbarium can be found on the WWW (http://www.utep.edu/~leb/).

The philosophy of collection development at Herbarium UTEP has been to document the regional flora from the perspective of floral diversity. The collection is viewed as an environmental collection that documents populations with precise data. A feature for most of the regional collections is a topographic locality map on each sheet. In the area of central Trans-Pecos Texas, across south New Mexico, to Arizona, the average common species is represented by 20-40 sheets. The collection has also been developed to represent Mexico and to develop a modest worldly component for its instructional and conceptual value. Collecting has also included lichens, mosses, and liverworts. The collection has an excellent regional documentation of the cryptogams.

A partial characterization of the holdings at UTEP using the searching capability of the Lotus program is as follows:

Sorted by country: USA 44243 Mexico 4839 Malaysia 1097 Australia 618 Belize 439 Trinidad & Tobago 406 Costa Rica 376 Indonesia 240 Philippines 208 Grenada 170

Sorted by states: Texas 16049 New Mexico 7011 California 3957 Arizona 3251 Colorado 1382 Durango 1124 Chihuahua 813 Wyoming 754

Sorted by counties in New Mexico and Texas: Hidalgo 1849 Dona Ana 1822 Hudspeth 1602 Luna 1465 Presidio 730 Culberson 673 Sierra 364 Grant 343 Otero 281 Lincoln 250

Sorted by taxonomic groups in New Mexico: Compositae 1094 Poaceae 587 Lichens 576 Fabaceae 396

Bryophytes 328 Cactaceae 145 Orchidaceae 46 Liverworts 38

Sorted by mountain masses: Franklin Mts. 3984 Hueco Mts. 1437 Organ Mts. 1180 Davis Mts. 951 Florida Mts. 778 Peloncillo Mts. 545 Black Range 517 Potrillo Mts. 441 Guadalupe Mts. 408 Bishop Cap Hills 394 Tres Hermanas Mts. 367 Little Hatchet Mts. 335 Big Hatchet Mts. 265 Apache Hills 217 Pyramid Mts. 178 Animas Mts. 126

Sorted by collector: Worthington, R.D. 18833 Pringle, C. 140 Fosberg, F.R. 100 Wooton, E.O. 1

The primary project based at Herbarium UTEP is the Floristic Inventories of the Southwest Program. The program is structured to document the floristic diversity on island mountain masses of different sizes. The floral inventories of the Organ, Franklin, Hueco, Florida, and Little Hatchet Mountains are essentially complete as well as some smaller inventories for the Bishop Cap Hills and the Tres Hermanas Mts.. A private publishing program will make these available to interested parties.

Herbarium UTEP handles routine loan requests and receives visitors as do other herbaria. Although listed in Index Herbariorum, we do not receive many requests for loans. We have started an international exchange program offering a representation of the Chihuahuan Desert flora.

Standards for the Writing of Floras

by Michael W. Palmer, Gary L. Wade, and Paul Neal

reprinted from BioScience 45(5):339-345. 1995.

Government agencies, private organizations, educational institutions, and the general public are increasingly interested in the preservation, restoration, and use of biodiversity (Harris 1984, Levin 1992, McNeely 1990, Norse et al. 1986, OTA 1987, Orr 1992, Tangley 1990, West 1993, Wilson 1988). This interest has created important new constituencies for the products of floristic research.

Floristic data are becoming more important for regional biological inventories, impact assessment, research, management decisions, and policy formulation. Taxonomic, site and ecological data are necessary to link floristic data with their environments to support objective decision making and validation of theoretical models that guide biodiversity management.

What is a flora?

The most common product of floristic research is the flora. We emphasize that the word flora has been variously defined (Morin 1989). Some botanists (e.g., Davis and Heywood 1973, Morin 1989) prefer to capitalize Flora to refer to a publication, while the lowercased flora refers to the actual plants existing in the region. However, we follow Lawrence (1951) who uses flora in a broad sense (and arguably the most widely accepted sense) to be an "inventory of the plants of a definite area." We consider an inventory to be a published, unpublished, or computer listing of species from a region of any spatial scale. Lawrence used the word manual for a flora with the addition of keys and descriptions for identifying and naming all the taxa of the area covered. To some others, floras must contain illustrations of species, while manuals do not. A plant atlas, which includes maps of specimens or county dot maps, can be considered a special case of a flora.

Some botanists limit use of the word flora to comprehensive works that include description and keys for large regions, as distinct from species lists for smaller regions, which are called florulas, checklists, species lists, inventories, botanical surveys, or assessments. We believe these distinctions are arbitrary. After examining several thousand floras, we have concluded that there is an uninterrupted continuum between simple checklists for small areas and multivolume, illustrated floras for very large regions.

Floras have been written for many purposes, including guides for identification, authorities for nomenclature, assessments of biological resources, and baselines for monitoring. Regardless of the comprehensiveness, the size of the region covered, or the intended purpose of the work, authors of floras (as described by Lawrence 1951) should adhere to a set of minimal standards, so future work can be more widely applicable.

Use of floristic data

The amount of data available in published floras is substantial. Based on an initial survey of the literature, we estimate that there are approximately 8000 different published floras describing areas of North America north of Mexico. With a conservative estimate of 500 person hours devoted to each flora, there have been at least 4,000,000 person hours invested in floristic research.

The data included in floras have already proved valuable. For example, floristic data have been used to test premises of island biogeography theory (Deshaye and Morisset 1988, Heatwole 1991), to study plant migrations and dispersal (Gates 1939, Heatwole and Walker 1989, Morton and Hogg 1989), to test abundance distributions for species within genera (Simpson and Todzia 1990), to evaluate the success of ecological restoration attempts (Thompson and Wade 1991), to evaluate phytogeographic patterns (Jurgens 1991, McLaughlin 1992, Morefield 1992, Shmida and Werger 1992, Thompson 1980, Wheeler et al. 1992), to reassess the biological species concept (Mayr 1992), to determine the expected number of species in unstudied regions (DeWolf 1964), and to evaluate the environmental determinants of biodiversity (Heikkinen and Kalliola 1990, Linder 1991).

The potential scientific uses of floristic data go far beyond academia. Wilken et al. (1989) list some potential users of floras in applied biology, including environmental consultants and engineers, silviculturists, farmers, lawyers, real estate appraisers, municipal planners, weed controllers, landscape architects, seed and feed companies, dermatologists, and customs officials.

Limitations of floras

We are currently compiling a database of floras from the United States and Canada. Our research has revealed that there is immense potential for the use of floras in comparative research. However, there are common shortcomings in otherwise well-implemented floras that greatly diminish their comparability to other floras. Although the missing data might have been considered irrelevant for the intended function of the flora, the data would in most cases have been easy for the authors to obtain and would certainly not have detracted from the intended function. These shortcomings limit biologists' ability to perform comparative research vital to understanding biodiversity.

We are not the first to note shortcomings in floras. Blake and Atwood (1942) were prompted to outline a set of essential features for floras, including an accurate title, an unambiguous delineation of the study area, a thorough exposition of methodology, and a statistical summary.

Several authors (e.g., Davis and Heywood 1973, Lawrence 1951, Wilken et al. 1989) have repeated, expanded, and/or commented on the necessity of including these and other basic pieces of information in

a flora. Nevertheless, many authors continue to omit essential information when publishing otherwise well-implemented floras.

Proposed standards

Table 1 lists what we consider to be minimal standards for all floras.

Table 2 lists nonessential but desirable information. We strongly recommend that editors and reviewers for journals, books, and government agencies use Table 1 as a guide when evaluating submitted manuscripts. Please note that we are asking authors to be diligent in preparing manuscripts; we are not suggesting that they follow a precise formula — the author should employ whatever format best suits the intended purpose.

Title. As floras come to be used by people who are not intimately familiar with the floristic literature, it is increasingly important that the title of the flora be clear, descriptive, and unambiguous. In addition, an unambiguous title would facilitate searches for titles in computer databases, which are now widely available and often include regional scientific publications.

The title should include a term or keyword indicating that the publication does indeed comprise a species list for a given area. We suggest that titles include the terms flora or vascular plant checklist, which are both descriptive and already in frequent use. The term vegetation is widely used for ecological purposes and does not necessarily imply the presence of a species list. While titles that include the phrases an assessment of the plants of... or species composition of... do suggest the presence of a species list, it is difficult to retrieve such ambiguous titles with a bibliographic search. Some terms (e.g., survey and inventory) are not ambiguous, but they are not commonly found in titles of other types of publications and, hence, are not likely to be used as keywords in computerized searches.

If the list of taxa is not the primary purpose of the publication, we suggest including a subtitle that contains the terms flora or vascular plant checklist. It is crucial that the title unequivocally specify the taxonomic scope of the flora (e.g., the vascular flora, woody plant checklist, angiosperm flora, cryptogam, and vascular plant flora). If the flora is limited to a particular season (e.g., spring flora), it should be noted in the title.

For the flora of a small area, both the specific site name and the general location should be included in the title. Although a specific site name may seem sufficient in a regional publication, the lack of a general location in the title makes the site difficult for researchers from outside the region to locate. The general locations are typically to be political designations such as counties, states, or provinces. Depending on the size of the area covered, the title should hierarchically include the county(ies), state(s) or province(s), country(ies), or other relevant political divisions that contain the surveyed region.

In the title, the site can be delineated by political (e.g., preserve, county, or park) or physiographic (e.g., watershed, island, or mountain range) boundaries. Although the latter might lead to some ambiguity about the specific boundaries of the coverage, the boundaries can and should be more clearly delimited in the text or a map.

The following are examples of well-formed flora titles: "Vascular plant flora of the Wager Bay Region, District of Keewatin, Northwest Territories" (Cody et al. 1989), "Checklist of vascular plants for the Bighorn Canyon National Recreation area, Wyoming and Montana" (Lichvar et al. 1985), and "The vascular flora of Cunningham Brake, A Cypress-Gum Swamp in Natchitoches Parish, Louisiana" (Mathies et al. 1983).

Location information. We have found that site information is often incomplete in floras (including, perhaps by oversight, large comprehensive floras). The site should be unambiguously delineated. At a minimum, the document should give the site name, state(s), county(ies), or other relevant political division, and latitude and longitude. If the site is small and not well known, unambiguous directions for reaching it should be given, or a map showing its location with respect to prominent landmarks should be included. If the area is greater than 25 km in maximal dimension, latitude and longitude to degrees and minutes (alternately, to hundredths of degrees) of the north-south and east-west boundaries, respectively, are desirable. In much of the western United States, township, range, and section unambiguously denote the location of a piece of property but should be presented in addition to, not instead of, latitude and longitude. No matter the size of the region, a map indicating its boundaries is highly desirable.

The length of a taxon list is so strongly determined by area (Williams 1964, Williamson 1988) that the area (in hectares or square kilometers) is one of the most important pieces of data to include. Comparative research is almost impossible without an assessment of area — one flora could contain more species than another simply because it was from a larger region and thus had a larger sample size (Palmer in press, Palmer and White 1994b). Knowing the area covered by a flora allows an objective evaluation of the relative richness of the flora compared with other floras of similar area in a region. A comparatively low richness for a given area might also indicate that additional floristic research may prove fruitful.

If the site is an island, a group of islands, or multiple, separate tracts, the total number of these locations and their separate areas should be given. For true islands, a matrix of shore and interisland distances is desirable, and the name of the body of water should be stated.

Environmental information. Just as it is impossible to have an absolutely complete flora, it is difficult to fully describe the environment of any region. Nevertheless, it is essential that at least a brief evaluation of the environment be given. When specific information is not available, as might be expected from some tropical locations, a brief summary of the current status of knowledge of the site or region would be helpful.

Essential data include the minimal and maximal elevations (in meters), physiographic region(s) as defined by standard geographic works, names of river systems draining the site, major impoundments, and major habitat or ecosystem types. The area covered by bodies of water should be presented if it is a significant portion of the total area.

Habitat and ecosystem descriptions may be arbitrary (Palmer and White 1994a), but where available, the use of a widely known habitat or ecosystem classification scheme is preferable (e.g., Kuchler 1964). If available, the absolute or relative fraction of the study site in each habitat/ecosystem type can be given. A brief description of geomorphology, surface geology, and soils should be included in both large and small floras. The number of identified soil series present is potentially useful as an index of environmental diversity present in the site. The references used to describe the physiography, geology, and soil must be cited.

Climatic data are desirable but difficult to standardize, especially for large regions. The nearest weather station(s) should be named, and its precise location (including elevation) relative to the site should be given. Desirable data include annual precipitation, temperature, and for regions outside the tropics, the mean dates for the first and last freeze. For large areas, if data are available, the spatial and temporal variation of these factors should also be given.

Past and present disturbance and human impacts on the study area such as history of glaciation, hurricanes, fire, logging, agriculture, mining, and recreational use should be described. The proportion of each study area that has been impacted by each type of disturbance should be given whenever practical.

Because human activities can have a strong impact on biodiversity, the human population density of the study area (or the surrounding county or counties, if the region is small) should also be given. There is admittedly some ambiguity in listing population density. The flora should note special situations. For example, a park in a region with low population density (e.g., the Great Smoky Mountains National Park) may experience intense recreational use. A county with high overall population density might contain some regions with low density.

Taxonomic scope. The taxonomic scope of the flora must be clearly delineated. Nomenclatural authority and principle sources used for identification must be cited. This information is extremely important — the quality and usefulness of a flora depend upon accurate identification and the proper use of names. It should be stated if the flora is intended as a nomenclatural authority. Where possible, nomenclature should follow modern synonymy, such as that provided by Kartesz (1994) or the Flora of North America editorial committee (1993a,b, other volumes in preparation), and relevant monographs should be consulted. It must be clearly stated whether or not there was an attempt to delineate taxa to an infraspecific (i.e., subspecific or varietal) rank; it is often not clear whether the infraspecific taxa are not known from the site or simply not recorded. Omission of particular taxonomic groups (sometimes done for pteridophytes and graminoids) should be avoided or must be stated explicitly early in the text.

The taxonomic breadth (e.g., vascular flora, woody flora, and angiosperm flora) must be stated in the title. Vascular floras are the most common and should be attempted wherever possible to allow comparability with other studies. However, there is also value in published work with a more limited scope.

Occasionally, published floras are even broader in scope than a vascular flora and include bryophytes, algae, and/or fungi (e.g., Bird 1975, Glaser 1992, Jordan 1874, Murray and Murray 1978). Such publications are rare, but they are of immense value in assessing biodiversity. Because they are rare, it is desirable that the broad nature of the publication be obvious from the title and that any summary of the taxa included should be assessed separately by major taxonomic groups.

Voucher specimens. The importance of voucher specimens cannot be understated (Goldblatt et al. 1992). Voucher specimens for all included taxa must be prepared, and the repositories of these specimens must be identified. Vouchers are not necessary if circumstances such as toxicity (e.g., Toxicodendron radicans) and endangered status prevent collection; the reasons for not documenting occurrence must be indicated in the text. If collection is impossible, a photographic record is desirable.

Botanical effort. For a small area, the collecting effort should be stated, though not necessarily in excessive detail (e.g., "John Doe collected vascular plants at two- to three-week intervals in 1984, and Jane Jones collected grasses several times per year from 1980 to 1990"). It should also be stated whether the species list is compiled from a limited number of sampling stations or whether an attempt was made to cover the entire region. If herbaria were searched for occurrences that are included in the published flora, the names and locations of these herbaria must be given. It also must be stated if the flora includes records from other published or unpublished floristic work. Taxa for which the authors have not seen living or pressed specimens should be listed separately, if at all.

Methods employed in the production of large, comprehensive floras are generally quite different from

the methods for floras of small regions. For large floras, the most important collectors and methods used in compiling the floristic data should be described in the preface, introduction, or an early chapter.

There is currently no widely accepted method to predict the completeness of a species list (Palmer in press). Nevertheless, most people performing floristic research have an informal assessment of how complete they believe their list to be. Even though such an estimate of completeness has no absolute comparative value, it may be of interest to the reader. If a scientist has an objective way of estimating the completeness of a list, for example, a collector's curve or rarefaction curve (Brewer and Williamson 1994, Grassle 1991), it should be stated.

Exotic or native origin. The origin of each species (i.e., whether it is native to the region or exotic) must be clearly indicated. We recommend that the ideal flora consists of all vascular plants growing spontaneously (i.e., the individual plants were not planted by humans). However, if other guidelines are employed (such as exclusion of taxa considered accidental, waif, persistent after cultivation, or exotic), they must be carefully stated and the terms defined. Exotic (alternatively, alien, naturalized, nonindigenous, nonnative, or introduced) species should be explicitly defined to indicate whether the classification represents, for example, "not native to the continent" or "not native to the eastern United States." The geographic origin of exotic species may also be useful to some flora users. In all cases, the source of data for determining status or origin must be cited.

The checklist. This checklist is the core of the flora. Taxa must be hierarchically listed by family in a logical order (e.g., in alphabetical order or in a standard taxonomic sequence such as that presented by Gleason and Cronquist [1991]). We recommend alphabetical order because standard sequences vary widely; if sequences are used they must be identified. The listing for each species must include the Latin binomial with authority. Punctuation, capitalization, and italicization should be in accord with Scientific Style and Format (CBE 1994) or Radford et al. (1974). If a standard synonymy is followed, the authorities are not necessary, but they are still highly desirable. The exotic origin of each species must be clearly indicated. Indications of new county or state records, endemism, and presence on state or federal protection lists are highly desirable. For floras of small scope, the collectors and collection numbers for each species included are desirable.

An assessment of the abundance of each species (ideally indexed by location or habitat) could increase the usefulness of a flora. There are potentially an infinite variety of abundance scales, and many such scales have been used in the past. The most desirable approach is to use a scale that has already been employed for the same or similar sites. In regions where no such abundance scale has been used, a proposed scale is given in Table 3. This scale is similar to, and easily reconciled with, the scales used in many published floras, and it therefore enhances comparative value. Admittedly, the assignment of many species to the correct abundance categories is highly subjective, but because the categories are so broad, putting species in the wrong category would probably be infrequent. A two-category change in species' abundance between different surveys of the same region may indicate an important change in that species' population.

Vernacular names are optional, but they do make floras more useful to the public. If they are included, it is desirable to list the names as used in a specific taxonomic flora or manual (if available), which then must be cited as the source of the names. It may also be of ethnobotanical interest to seek out the names in general use by local residents, in which case the methods (even if not systematic) must be stated.

The precise format of coding all of the above information is unimportant, but it should be clear and concise. Superscripts, prefix codes, asterisks, and use of different fonts are useful for indicating exotic status, threatened status, and abundance measures. Any format employed must be fully explained in the text.

Context. The author of a flora may want to describe where the work stands in relation to other published works. The context of a published flora includes defining relationships with published floras of smaller included areas, earlier floras of the same area, floras of neighboring areas of both similar and contrasting environments, floras of larger areas that include the area covered by the new flora, and ecological works on the vegetation of the area.

Summary statistics. A table must be included that lists, at minimum, the total number of families, genera, and species and the percentage and/or number of exotic and native species. Listing the number of subspecific taxa is optional but desirable if they were identified. Tabulation using other subdivisions (e.g., classification by major taxonomic group, life form, or biogeographic affinities) may be desirable if it assists the overall objectives of the publication. Table 4 presents a hypothetical example of a table meeting the standards.

The phrase total number of taxa is widely but inconsistently used. For example, it has variously designated the total number of species, the number of species plus subspecies and varieties (sometimes thereby counting a variety that is the sole representative of a species twice), or the number of species plus genera plus families. This inconsistency makes it difficult to use floras comparatively. Because of its ambiguity, the phrase total number of taxa should be abandoned unless its meaning is clearly defined.

Because the number of higher-level taxa varies substantially depending upon the taxonomic treatment used, summary tables may be difficult to use comparatively. However, if the taxonomic treatment is listed, a scientist performing comparative work is likely to be able to make the appropriate adjustments.

Electronic copies. Floras typically possess hundreds to thousands of species. This size makes the input of data into computers one of the most time-consuming aspects of comparative floristic research. Such research would be greatly assisted if authors made their floras available also in electronic form. This format should not be difficult because most authors now prepare manuscripts using word processors. At the end of the list of taxa, authors should state whether the list is electronically available, and if so, which author to contact, the nature of the file (e.g., ASCII, word processor, database, or spreadsheet), the medium (e.g., tape or diskette), the operating system used, and the cost.

How well do floras meet the criteria?

The proposed standards in Table 1 appear modest. Nevertheless, it is surprising how many floras do not meet many of these basic criteria. From our growing collection of more than 1800 floras from the western United States and Canada, we randomly selected 100 floras published after 1969 to check for conformation to our proposed standards (Table 5). Floras included standard, widely available journals and books. Reports from governmental agencies or private organizations and unpublished lists were not considered because they are less likely to be peer-reviewed than other floras.

Evaluation of conformation to the criteria was adjusted to account for the scale of the flora. For example, a large, comprehensive flora intended as a nomenclatural authority would automatically conform to the criterion of nomenclatural authority cited. We found that large comprehensive books are not necessarily more complete or informative than short journal papers.

The future of floras

Floristic research has entered the computer age. Whenever possible, botanists writing floras should take advantage of new tools such as specimen-based computer databases (Allen 1993, Morain 1993, Morin and Gomon 1993).

At first, it might seem that current trends are likely to obviate the need for written floras. However, it is unlikely that floras will be made obsolete in the indefinite future. Computerized plant databases have some serious limitations (Allen 1993). Also, people responsible for managing biodiversity are always likely to have a need for a site-based presentation of taxa (i.e., a flora) in addition to specimen-based presentation of taxa. We envision a bright future for floras in which specimen-based databases assist the development of floras and vice versa.

Conclusions

We hope that the worldwide concern for management and preservation of biodiversity brings about a resurgence of floristic research. By expanding the scope of their already valuable research, botanists are likely to increase the completeness and use of the floras they produce. This expansion should not require much additional effort, because the basic data are in most cases easily available to the authors — the data are certainly more likely to be available to the authors than to the readers. The necessary information is easily presented in short paragraphs or small tables, so publication costs should not be substantially increased. The modest standards proposed here should not interfere with the many purposes that authors have intended for their work.

Acknowledgments

We thank Suzanne McAlister, Julie Ann Miller, Ralph Thompson, Ronald Tyrl, Dieter Wilken, and four anonymous reviewers for comments on previous versions of this article. We also thank a plethora of botanists (too numerous to list here) for supplying us with floras for our database. This study was supported, in part, by the Oklahoma Water Resources Center and by the USDA Forest Service (USDA Cooperative Agreement 23-768).

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Tables have not been posted on this page. Please see hard copy.

New Plant Distribution Records

New records for New Mexico are documented by the county of occurrence and the disposition

(herbarium) of a specimen.

— McIntosh (Phytologia 81:365-368. 1996)

Baccharis havardii A. Gray (Asteraceae): Otero Co. (NMC).

Gnaphalium leucocephalum A. Gray (Asteraceae): San Miguel & Hidalgo Cos. (NMC).

Brassica tournefortii Gouan. (Brassicaceae): Dona Ana Co. (NMC).

Plantago bigelovii a. Gray (Plantaginaceae): Hidalgo Co. (NMC).

Valeriana sorbifolia H.B.K. (Valerianaceae): Hidalgo Co. (NMC).

Bouchea prismatica O. Kuntze var. brevirostra Grenz. (Verbenaceae): Hidalgo Co. (NMC).

Verbena gracilis Desf. (Verbenaceae): Hidalgo Co. (NMC,SNM); Mora Co. (NMC).

— Zander & Weber (The Bryologist 100:237-238)

Didymodon anserinocapitatus (X.-j. Li) Zand. (Pottiaceae): San Miguel Co. (DUKE).

— Roger Peterson (1750 Camino Corrales, Santa Fe, NM 87505).

Bromus sterilis L. (Poaceae): Santa Fe Co. (pers. herb.).

— Robert Sivinski (P.O. Box 1948, Santa Fe, NM 87504) - interesting second records for these species:

Prenanthella exigua (Asteraceae): San Juan Co. (UNM).

Cryptantha oblata (Boraginaceae): Hidalgo Co. (UNM).

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The New Mexico Botanist

Issue Number 7, February 18, 1998

The Correct Spelling of Commemorative Epithets

by Paul Silva

reprinted from The Jepson Globe 8(2):1,3.

The second installment of Jepson Manual Corrections (Jepson Globe Vol. 7, No. 2) includes notes on the orthography (correct spelling) of specific and infraspecific epithets. Clarification of these notes (which were repeated in the third installment, Vol.7, No.3) seems useful since they give the impression that the correction of misspelled epithets is always optional when in fact it is usually obligatory.

A peculiarity of the International Code of Botanical Nomenclature (ICBN) is that certain recommendations pertaining to orthography (Rec. 60C. 1, 60G, and 60H) are enforced by rules and hence are not really recommendations. The first two affect The Jepson Manual, while the third concerns only fungi.

Rec. 60C. 1, which governs the orthography of specific and infraspecific epithets based on personal names, is enforced by Art. 60.1 1. Grammatically, there are two kinds of commemorative epithets, substantival and adjectival. A substantival commemorative epithet is a noun in the genitive (possessive) case. The inflection (ending) of the epithet varies according to the sex and number of the person(s) being commemorated. Personal names that end in a consonant (except y, which in final position functions as a vowel) can be converted to substantival epithets by the interpolation of -i plus the genitive ending appropriate to the sex and number of the person(s), i.e., -i for a man, -ae for a woman, -arum for two or more women, and-orum for two or more men or persons with both sexes represented. Thus, Chaenactis parishii (Samuel Parish), Lasthenia ferrisiae (Roxana Ferris), and Ceanothus hearstiorum (the Hearst family). Personal names that end in -er are a curious exception among those ending in a consonant in that they do not take the interpolated i. Thus, Phacelia breweri (William Brewer), Horkelia wilderae (Mrs. H. E. Wilder), and Cordia wagnerorum (Dr. and Mrs. Richard J. Wagner).

Personal names that end in -e, -i, -o, u, or -y also can be converted to substantival commemorative epithets by the addition of the appropriate genitive inflection (-i, -ae, -arum, or -orum) without interpolating an i. Thus, Eryngium constancei (Lincoln Constance), Eriastrum brandegeeae (Katherine Brandegee), Downingia bacigalupii (Rimo Bacigalupi), Astragalus serenoi (Sereno Watson), Carex rousseaui (Jacques Rousseau), Polystachya moreauae (Mrs. R. E. Moreau), Delphinium parryi (Charles Parry), and Linanthus parryae (Mrs. Charles Parry). Personal names that end in -a are a special case: like other names ending in a vowel, they do not take the interpolated i, but the genitive inflection is limited to -e (singular) or -rum (plural) regardless of sex. Thus Aster greatae, which commemorates Louis Greata, would be equally correct for Mrs. Greata, while greatarum would commemorate both persons.

An adjectival commemorative epithet is a noun converted to an adjective by the addition of a suffix (-

an), which is inflected in accordance with the gender of the generic name (-anus, -ana, -anum) but is not affected by the sex or number of the person(s) being commemorated. Personal names ending in a consonant, including those that end in -er, require an interpolated i preceding the suffix. Thus, Bromus orcuttianus (Charles Orcutt), Iris douglasiana (David Douglas), Eriogonum eastwoodianum (Alice Eastwood), and Astragalus jaegerianus (Edmund Jaeger). Personal names ending in -e, -i, -o, -u, and -y take the suffix without an interpolated i. Thus, Pogogyne clareana (Clare Hardham), Eriogonum covilleanum (Frederick Coville), Sphaeralcea munroana ("Mr. Munro"), and Clarkia dudleyana (William Dudley). Personal names that end in -a are a special case: like other names ending in a vowel, they do not take the interpolated i, but the suffix is reduced to -nus, -na, or num. Thus, we have Astragalus claranus (Clara Hunt), and not A. clarianus as originally spelled by Jepson.

It should be emphasized that the orthography of substantival commemorative epithets depends solely on the sex and number of the person(s) being commemorated, while the orthography of adjectival commemorative epithets depends solely on the gender of the generic name in which the epithet is used. Thus, we have Mimulus bolanderi, Madia bolanderi, and Trifolium bolanderi (Henry Bolander) compared with Lotus nuttallianus, Puccinellia nuttalliana, and Delphinium nuttallianum (Thomas Nuttall), when used with masculine, feminine, and neuter generic names, respectively.

In The Jepson Manual, substantival commemorative epithets, when translated, are correctly translated as a possessive, such as Bolander's clover. Adjectival commemorative epithets, when translated, are translated in the same manner. A more literal, but rarely used translation would be, for example, Nuttallian lotus and Eastwoodian buckwheat. Substantival commemorative names are much more common than adjectival commemorative names.

Not all contributors to The Jepson Manual interpreted correctly the rules governing the orthography of specific and infraspecific epithets. Although the editors made an earnest effort to bring the orthography into conformity with the ICBN, a few incorrectly spelled epithets persisted. The following names have incorrectly spelled commemorative epithets and are to be corrected (obligatorily) without change of author or date:
p. 402 Arabis pinzlae to A. pinzliae
p. 573 Ditaxis clariana to D. claryana (Marjorie Clary)
p. 592 Astragalus clarianus to A. claranus (Clara Hunt)
p. 632 Lupinus holmgrenanus to L. holmgrenianus
p. 726 Salvia brandegei to S. brandegeei (T. S. Brandegee)
p. 826 Eriastrum brandegeae to E. brandegeeae (Katherine Brandegee)
p. 935 Ceanothus ferrisae to C. ferrisiae
p. 1178 Allium sharsmithae to A. sharsmithiae
p. 1195 Fritillaria brandegei to F. brandegeei (I. S. Brandegee)

Rec. 60G, which deals with connecting vowels in compound epithets, is enforced by Art. 60.8. The following names in The Jepson Manual have incorrectly formed epithets and are to be corrected (obligatorily) without change of author or date:
p. 146 Eryngium alismaefolium to E. alismifolium
pp. 758, 759 Sidalcea malvaeflora to S. malviflora
p. 1130 Carex luzulaifolia to C. luzulifolia

It should be noted that Rec. 60C.2, which governs the orthography of specific and infraspecific epithets based on personal names already in Greek or Latin or possessing a well-established latinized form (a subjective decision!), is not enforced by a rule. Therefore, the requirement to retain the original spelling of a name or epithet (Art. 60.1) means that the protologue must be consulted. Swallenia alexandrae as given in The Jepson Manual (p. 1299) is correct because Swallen used this spelling when publishing the

basionym, Ectosperma alexandrae, named after Annie Alexander. Eriogonum ochrocephatum var. alexanderae (p. 878), also named for Annie Alexander, is similarly correct, although contrary to Rec. 60C.2, because Reveal used this spelling when proposing the variety. Assuming that Maximilianus is a well established latinized form of Maximilian, Helianthus maximiliani as originally written by Schrader is correct rather than H. maximilianii.

Quercus wislizenii as used in The Jepson Manual (p. 662) follows Rec. 60C.2 in converting a personal name already in Latin to a substantive epithet by using the appropriate Latin genitive. The honoree, however, spelled his name Wislizenus rather than Wislizenius, yielding wislizeni, as originally proposed by Alphonse DeCandolle.

Rec. 60C.2 discourages treating modern names that end in -o and -on as if they were Latin and thus using the genitive inflection -onis. Such a practice was widespread among older authors, however, so that such epithets as chamissonis (Adelbert von Chamisso), congdonis (Joseph Congdon), ecklonis (Christian Ecklon), guiradonis (F. Guirado), and Richardsonis (Sir John Richardson) are in The Jepson Manual and, while contrary to Rec. 60C.2, are correct.

A Clarification of Centaurea

A Clarification of *Centaurea americana* and *Centaurea rothrockii* (Compositae: Cardueae).

by Eric Roalson and Kelly W. Allred

ABSTRACT

Centaurea americana and Centaurea rothrockii are two closely related basketflowers that have been confused in herbarium collections. Four hundred and seventy-eight specimens from across the range of each species were studied to determine the morphological differences between them. Centaurea americana and C. rothrockii can be differentiated by the number of medial phyllary lobes (5-7 vs. 10-13, respectively), and by the color of the upper portion of the phyllary (straw colored vs. dark brown). Full descriptions of both species are provided as well as their geographic ranges and habitat preferences.

INTRODUCTION

Centaurea (Compositae: Cardueae), described by Linnaeus in 1753, is composed of approximately 500 species (Bremer 1994). The circumscription of this genus has varied widely, with several of the sections of Bentham (1873) and Hoffmann (1890) recognized as genera by Wagenitz (1955, 1962, 1963) and Dittrich (1966, 1968). Even more severe generic splitting of Centaurea has been proposed by Holub (1973, 1974) and Dostdl (1975).

Centaurea ranges throughout Eurasia, North and East Africa, and North America, with a few species in South America (Bremer 1994). Several species are rather weedy and have invaded elsewhere. Only two species are native to North America (Centaurea americana and C. rothrockii) and are the topic of this paper.

In 1821, Nuttall described Centaurea americana. He characterized the species as a tall annual (4-6 ft) with the "...calix [involucre] ... large and partly globular, its segments [phyllaries] furnished with

pennate, recurved, sphacelous, and shining appendages, the internal ones purplish." He also described the rays as being long and reddish. This species was described from a collection made somewhere in "the upper part of Arkansa territory." The information with the type collection is similarly vague. Two sheets are in the type folder at PH. The first sheet is composed of material from two collections: a Nuttall collection annotated "Red River (Nutt.)" and a collection by Palmer from "Arizona." The second sheet is composed of material annotated by Nuttall with "Arkansa." The two specimens annotated by Nuttall are most likely the material referred to in the original description.

Greenman described a similar species, Centaurea rothrockii, in 1904. Included with his description was a key differentiating C. rothrockii from C. americana. Centaurea americana was characterized as having "involucral bracts stramineous or the inner ones slightly purplish, pectinate with 3-8 pairs of lateral firm teeth." Centaurea rothrockii was described as having "involucral bracts greenish or stramineous below, conspicuously tipped with chestnut-brown, pectinate-fimbriate with 8-12 pairs of lateral rather slender teeth." Greenman cited Rothrock 527 from "Arizona: Chiricahua" as the type collection. Type material was not available to us for study.

Even though Greenman stated rather clearly the differences between the two species, and the most recent floral manuals for Arizona (Kearney and Peebles 1960) and New Mexico (Martin and Hutchins 1981) (the only USA states where both species occur) distinguished the two in an equally well-defined manner, we have found many misdetermined herbarium specimens. This paper clarifies the differences between the two species and discusses the geographic range and habitat of each species.

MATERIALS AND METHODS

Four hundred and seventy-eight specimens were examined from across the geographic ranges of Centaurea americana and C. rothrockii. Centaurea americana, being much more commonly collected, was represented by 362 specimens, whereas C. rothrockii was represented by 116 specimens.

To estimate the number of pairs of lobes per phyllary, the number of lobe pairs on one phyllary of one head per specimen was counted, using a phyllary from the middle of the head (hereafter referred to as medial phyllaries). Variation in the color of the phyllaries was noted for each species, and compared to Smithe's (1975) color guide.

RESULTS

An initial survey of all specimens did not reveal any detectable morphological differences between the two species other than the number of lobes on the phyllaries and the phyllaries coloration, features used by Greenman (1904) to separate them.

A high degree of variation was found in the number of phyllary lobe pairs even within a single head. Observations from three plants of Centaurea americana (chosen from across the species range) found that the number of lobes within a single head ranged from 4-8 pairs (plant 1) to 2-7 pairs (plants 2 & 3). In three plants of C. rothrockii, the number of pairs of lobes ranged from 7-15 pairs (plant 1) to 5-14 pairs (plant 2) to 7-11 pairs (plant 3). Those phyllaries toward the base of the head were small and poorly developed and those at the top of the head tended to be identical for both species. Also, the ranges in the number of phyllary lobes of the two species overlapped if all the phyllaries in a head were considered. However, when only the medial phyllaries were considered, a sharp distinction between the two species was achieved. The number of phyllary lobe pairs ranged from four to eight for C. americana and from nine to 15 for C. rothrockii.

There were obvious differences between Centaurea americana and C. rothrockii in the coloration of the upper portion of the phyllaries. Phyllaries of both species tended to grade from a darker color at the base of the upper, lobed portion to a slightly lighter color on the lobes themselves. The upper portion of C. americana phyllaries were usually a light to dark straw color (Buff-Yellow [Color 53] to Buff [Color 241] of Smithe 1975) with the lobes being nearly the same color. The phyllaries of C. rothrockii tended to be a medium brown to dark brown (Raw Umber [Color 23] to Dusky Brown [Color t9] of Smithe 1975) with the lobes often nearly white. Many C. americana specimens from the late 1800s and early 1900s have phyllaries that are much darker than later specimens, almost a bronze color. Perhaps the phyllaries of C. americana darken with age and drying? This difference was not observed in C. rothrockii.

Both Centaurea americana and C. rothrockii have small scabrate hairs on the phyllaries, often giving the phyllary lobes a ciliate appearance. This is most obvious on C. rothrockii, where the light-colored hairs stand out against the darker phyllaries.

Kearney and Peebles (1960) also used the shape of the undivided, upper portion of the phyllary to distinguish the two species. They characterized this region in Centaurea americana as lanceolate and in C. rothrockii as broadly triangular or ovate. We found that the shape of the undivided, upper portion of the phyllary intergraded completely, and the two species can not be distinguished using this feature.

McVaugh (1984) discussed some additional putative differences between Centaurea americana and C. rothrockii. He stated, "...C. americana may be distinguished by ... the peduncles evidently gland-dotted and strongly angled but glabrous or sparingly pubescent." In our observations both species often had gland- dotted and strongly angled peduncles and both varied widely in vestiture.

Additionally, Centaurea americana and C. rothrockii differed somewhat in plant height and flower color, though the differences were not diagnostic. Centaurea americana tended to be taller, mostly 8-15 dm, whereas C. rothrockii was generally shorter, 3-10 dm. The rays of C. americana were usually purple or pink on the outside of the head and white or yellow on the inside of the head, though the color of the rays ranged from all purple or pink to all yellow or all white. Centaurea rothrockii had all purple flowers, all yellow flowers, or a combination of purple and yellow flowers (purple on the periphery of the head and yellow in the center of the head).

The geographic ranges of Centaurea americana and C. rothrockii were discrete for the most part, with overlap only in southeastern Arizona (Cochise Co.), southwestern New Mexico (Grant Co.), and northern Chihuahua (Fig. 1). When the species occurred in the same region, their populations were allopatric in terms of habitat and elevation. Centaurea americana primarily occurred in prairies and plains, often along roadsides and in disturbed ground, and at low elevations, from sea level to approximately 2100 m. Occasionally this species was found in wooded foothills, but still in somewhat weedy habitats. Centaurea rothrockii, on the other hand, was primarily a species of the Sierra Madre Occidentale whose range barely entered the mountains of southwestern New Mexico and southeastern Arizona. This species appeared to always occur in relatively undisturbed mountain vegetation at generally higher elevations, 1350-2700 m. We found no localities where the two species occurred together.

The following key can be used to identify the two species:
1. Medial phyllaries with (4)5-7(8) pairs of lobes, upper portion light to dark straw-colored ..... C. americana
1. Medial phyllaries with (9)10-13(15) pairs of lobes, upper portion medium brown to dark brown ..... C. rothrockii

TAXONOMY

CENTAUREA AMERICANA Nutt., J. Acad. Nat. Sci. Philadelphia 2:117-118. 1821. non Rothrock, 1878. Type: "Arkansa", Nuttall s.n. (holotype: PH!).
Centaurea nuttallii Spreng., Syst. Veg. 4 (Suppl.):298.1827.
Plectocephalus americanus (Nutt.) Don in Sweet, Brit. Fl. Gard. 2: pl. 51. 1831.
Centaurea mexicana DC. in DC., Prodr. 6:575. 1837.
Description: Erect annuals. Stems (3)8-15 dm tall, simple below, branched above, grooved, glabrous below to minutely scabrous and glandular above. Leaves (2)4-8(10) cm long, alternate, simple, lanceolate to oblong-lanceolate, the basal leaves sometimes spatulate, glabrous to scabrous on both surfaces; margins entire to remotely denticulate, often mucronate at the apex. Peduncles thickened above, scabrous to tomentose, glandular. Heads solitary at the ends of branches. Involucres 3-5 cm long, subcampanulate. Phyllaries in several series, imbricate, each phyllary articulated into two parts; lower part entire, broadly elliptic to linear, light straw colored to light green and striate, occasionally tomentose; upper part lanceolate to deltoid in outline, light to dark straw-colored, bearing (4)5-7(8) pairs of subulate lobes. Phyllary lobes usually the same color as the rest of the phyllary, obscurely to conspicuously ciliate. Corollas 2-2.5 cm long, usually with the peripheral rays purple or pink and the central rays yellow or white, occasionally all rays purple or yellow, the peripheral rays usually much longer than the central rays. Pappus of minutely barbellate bristles 6-14 mm long, in one or two series. Achenes 4-5 mm long, oblong-obovate, brown to black, obscurely striate, usually glabrous, attached at an obliquely leveled area just above the base.
Habitat: Prairies, plains, open fields, and roadsides, often in disturbed areas, occasionally on wooded slopes in the foothills; soils rocky and xeric to clayey; from approximately sea level to 2100 m.
Distribution: Central United States to east-central Mexico (Fig. 1). United States: Arizona, Arkansas, Kansas, Louisiana, Missouri, New Mexico, Oklahoma, and Texas. Mexico: Chihuahua, Coahuila, Nuevo Leon, Queretaro, San Luis Potosi, and Tamaulipas.

CENTAUREA ROTHROCKII Greenm., Bot. Gaz. 37:219-222. 1904. Type: Chiricahua, Arizona, Rothrock 527 (holotype: GH, not seen).
Description: Erect annual or biennial herbs. Stems 3-10 dm tall, simple below, sparingly branched above, grooved, glabrous or slightly scabrous. Leaves 3-12 cm long, alternate, simple, lanceolate to oblong- lanceolate, the basal leaves sometimes spatulate, glabrous to scabrous on both surfaces; margins entire to remotely denticulate, often mucronate at the apex. Peduncles thickened above, scabrous to tomentose, glandular. Heads solitary at the ends of branches. Involucres 3-5 cm long, subcampanulate. Phyllaries in several series, imbricate, each phyllary articulated into two parts; lower part entire, broadly elliptic to linear, beige to light green and striate, occasionally tomentose; upper part lanceolate to deltoid in outline, medium brown to dark brown, bearing (9)10-13(15) pairs of subulate lobes. Phyllary lobes often whitish, usually conspicuously ciliate. Corollas 2-2.5 cm long, the rays commonly all purple or yellow, sometimes the peripheral rays purple and the central rays yellow, the peripheral rays usually much longer than the central rays. Pappus of minutely barbellate bristles 6-14 mm long, in one or two series. Achenes 4-5 mm long, oblong-obovate, brown to black, obscurely striate, usually glabrous, attached at an obliquely leveled area just above the base.
Habitat: Meadows, roadsides, streamsides, and wooded canyons in the mountains; calcareous, rocky ground to moist, silty or clayey soils; approximately 1350-2700 m.
Distribution: Southwestern United States to south-central Mexico (Fig. 1). United States: Arizona and New Mexico. Mexico: Chihuahua, Durango, Jalisco, Mexico, Morelos, Oaxaca, Sinaloa, and Sonora.

ACKNOWLEDGEMENTS

Appreciation is expressed to Norman Jensen for help with data gathering. We thank the following herbaria for their cooperation: ARIZ, CAS, JEPS, KSC, MICH, MO, NLU, NMC, NMCR, PH, TAES,

UC, UNM, and US.

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[Fig. 1 has not been posted to this page. See hard copy]

New Plant Distribution Records

New records for New Mexico are documented by the county of occurrence and the disposition (herbarium) of a specimen.

— Bob Sivinski (P.O. Box 1948, Santa Fe, NM 87504)
Penstemon ophianthus Pennell (Scrophulariaceae): San Juan Co. (UNM).
Mentzelia marginata Thompson & Prigge (Loasaceae): San Juan County (UNM).
Paronychia depressa (Torr. & Gray) Nutt. ex A. Nels. (Caryophyllaceae): Harding Co. (UNM).
Arenaria hookeri Nutt. ex Torr. & Gray (Caryophyllaceae): Torrance Co (UNM).

— Thomas Adams (Range Science Herbarium, Box 3-I, New Mexico State University, Las Cruces, NM 88003)
Tillaea aquatica L. (Crassulaceae): Catron Co. (NMCR).
Cyperus bipartitus Torrey (Cyperaceae): Catron Co. (NMCR).
Myriophyllum verticillatum L. (Haloragaceae): Catron Co. (NMCR).
Heteranthera rotundifolia (Kunth) Griseb. (Pontederiaceae): Harding & Hidalgo Cos. (UNM).

— Kelly Allred (Range Science Herbarium, Box 3-I, New Mexico State University, Las Cruces, NM 88003)
Rumex pulcher L. (Polygonaceae): Dona Ana Co. (NMCR) [second report].

— Tom Todsen (2000 Rose Lane, Las Cruces, NM 88005) reported from Freudenstein (1997) and Catling & Engel (1993)
Corallorhiza striata Lindl. var. vreelandii (Rydb.) L.O. Wms. (Orchidaceae).
Corallorhiza maculata Raf. var. occidentalis (Lindl.) Ames (Orchidaceae).
Hexalectris spicata (Walt.) Barnh. var. arizonica (S.Wats.) Catling & Engel (Orchidaceae): Otero Co. (UNM).

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Fryxell, P.A. 1997. The American genera of Malvaceae - II. Brittonia 49(2):204-269. [includes a key to genera]

Hedenas, L. 1997. A partial generic revision of Campylium (Musci). The Bryologist 100:65-88.

Holmgren, N.H. ed. 1998. Illustrated Companion to Gleason and Cronquist's Manual. New York Botanical Garden. ISBN 0-89327-399-6. $125.

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[There are numerous reports and discussions concerning rare New Mexico plants on the New Mexico

Rare Plant Technical Council web site; see page 8.]

Miscellaneous, Agriculture, Ecology, Etc.:

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Journals, Newsletters, Etc.:

Native Plant Society of New Mexico Newsletter. Tim McKimmie, 1105 Circle Drive, Las Cruces, NM 88005.

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The New Mexico Botanist

Issue Number 8, April 23, 1998

San Juan College Herbarium (SJNM)

by Kenneth Heil & Linda Mary Reeves
San Juan College, 4601 College Boulevard, Farmington, NM 87404

The San Juan College Herbarium (acronym SJNM) is located in the Mathematics/Science/Health Careers Building on the beautiful San Juan College campus in Farmington, New Mexico. The SJC herbarium was instituted and developed by Ken Heil. After many years of occupying the edges of the Geology-Plant Systematics Laboratory, the college graciously and extensively renovated the old radio station suite of rooms into a modern, technology-accessed facility with plenty of space to accommodate even the cabinets donated by the Smithsonian Institution. As the herbarium gets quite a bit of use, both by academic workers and surveyors for environmentally based agencies and businesses, this change is most welcome.

With over 25,000 mounted specimens, and many more thousands in processing, SJNM is the third largest herbarium in New Mexico and the largest in the Four Corners area. Significant collections include part of the Vassey collection and extensive collections from area national parks and monuments, as well as collections from the Navajo Reservation and other under-collected areas of the Four Corners region, including alpine and subalpine areas. The majority of specimens are from the Four Corners region, with large collections from New Mexico, California, and Baja California. The Reeves collection, which is in processing, includes many ferns and orchids of the Southwest and northern Mexico. An extensive Heil Cactaceae collection is a major and important feature. The herbarium has many specimens in the Polemoniaceae and a number of significant type collections, including Asclepias sanjuanensis.

Several projects are on-going, including the San Juan Basin Flora project, in conjunction with Rancho Santa Ana Botanic Garden, Claremont, California and Fort Lewis College in Durango, Colorado. San Juan College is coordinating the effort and the three institutions have pledged publishing costs and support for student workers. Additional support is supplied and expected to be supplied by government agencies and private industry. An interesting and unusual feature of the flora will be approximately 50 color drawings by renowned artist Carolyn Crawford and about 500 black and white line drawings by Linda Reeves. Contributors come from major institutions throughout the western and midwestern U.S., including the institutions mentioned, Arizona State University, University of New Mexico, New Mexico State University, Brigham Young University, University of Michigan, New York Botanical Garden, and many others. Contributors are still needed in a few areas, especially for Convolvulaceae, Lamiaceae, Malvaceae, Onagraceae, Salicaceae, and Solanaceae. Anyone who is interested in participation is invited to contact the authors at the address above Since the area has been so poorly known botanically, the San Juan Basin Flora will prove to be an important regional flora.

Other on-going projects include work by Ken Heil on Sclerocactus and Pediocactus, including

treatments for the new Vascular Plants of Arizona and Flora of North America, Orchidaceae of Arizona and reproductive biology of Malaxis by Linda and Timothy Reeves, and flora of the Grenadiers by Cyndie Holmes.

The Genus Cryptantha in New Mexico

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CRYPTANTHA Lehm. ex G. Don

Annual, biennial, or perennial herbs, strigose (rarely glabrate) and often hirsute or hispid- setose; leaves narrowly oblanceolate, spatulate, or occasionally linear; flowers in most species borne in a series of helicoid, naked or bracteate false racemes or false spikes (modified cymes) usually elongating with maturity or often short and aggregated into a terminal thyrse or capitate cluster; calyx cleft to the base or nearly so; corolla white or ochroleucous (bright yellow in C. flava), salviform with a spreading or rotate limb and fornices at the throat (these often yellow); anthers included in the corolla tube; usually homostylous, but heterostylous in a few perennial species; stigma capitate; ovules usually 4 (C. recurvata is exceptional with only 2 ovules); nutlets (mericarps) 4, or 1-3 by abortion, triangular, ovate to lanceolate, smooth to variously roughened, heteromorphic or all similar, affixed to an elongate gynobase, the ventral scar either closed, narrowly open, or forming a triangular areola.

A diverse genus of about 150 species in the western half of North America and arid regions of South America (23 in New Mexico). A few authors prefer to maintain the biennial and perennial species in the genus Oreocarya. There are, however, no exclusive characteristics to separate annual species from the perennials (Subgenus Oreocarya). The single- species Section Eremocarya is represented by C. micrantha. All other New Mexico annuals belong to Section Krynitzkia.

Cryptantha is especially interesting for its complex reproductive strategies ranging from autogamy to out-crossing reinforced by heterostyly. Various forms of nutlet abortion are evident to some degree in almost all our species. Abortion rates can be relatively mild and random, or taken to an extreme where only one nutlet at a genetically fixed location is matured in each flower. This has led to nutlet heteromorphy in some annual species where a single (always matured) nutlet is larger and/or more firmly attached to the gynobase while the three consimilar nutlets are deciduous and randomly matured a various rates, or always aborted. The persistent odd nutlet is dispersed as a unit with the calyx.

Nutlet shape and surface ornamentation are often important diagnostic criteria for Cryptantha. Species determinations will usually require mature specimens. (Greek cryptos - hidden, and anthos - flower, for the cleistogamous flowers of the original South American species.)

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Key to Cryptantha Species in New Mexico

1. Plants biennial or perennial; corolla conspicuous (limb 4 mm or greater in diameter) 2
-- Plants annual; corolla limb usually 0.5-3.0 mm broad (up to 6 mm in C. crassisepala) 12

2(1) Dorsal surface of mature nutlets smooth and shiny 3
-- Dorsal nutlet surface roughened with tubercles, murications, or wrinkles (rugose) 5

3(2) Entire corolla yellow; nutlets straight-lanceolate, usually maturing 1/calyx (rarely 2) ..... C. flava
-- Corolla limb white (tube and fornices often yellowish); nutlets ovate-lanceolate, decidedly curved inward towards the style, usually maturing 4/calyx (sometimes fewer by abortion) 4

4(3) Interior base of corolla tube ringed with small (<1 mm) antrorse scales; plants evidently perennial ..... C. cinerea
-- Corolla tube lacking basal scales; plants biennials or short-lived perennials ..... C. palmeri

5(2) Corolla tube elongate, usually exceeding the calyx by at least 2 mm 6
-- Corolla tube about equal to, or barely surpassing the calyx 9

6(5) Nutlets muricate (the murications sometimes setulose-tipped), usually maturing 1/calyx (sometimes 2) ..... C. fulvocanescens
-- Nutlets rugose or tuberculate; usually maturing 4/calyx (sometimes fewer by abortion) 7

7(6) Nutlets lance-ovate, straight, scar narrowly open for nearly entire length, northwestern NM ..... C. paradoxa
-- Nutlets ovate, decidedly curved toward the style, scar closed for entire length, southern and east-central NM 8

8(7) Flowers heterostylous; corolla limb 10-14 mm in diameter, fornices bright yellow ..... C. paysonii
-- Flowers homostylous; corolla limb 6-10 mm in diameter, fornices white or pale yellow ..... C. oblata

9(5) Nutlet margins conspicuously papery-winged; plants coarse, 4-10 dm tall ..... C. setosissima
-- Nutlet margins not papery-winged; plants smaller, <5 dm tall 10

10(9) Corolla tube 6-10 mm long; nutlets decidedly bent toward the style ..... C. oblata
-- Corolla tube 6 mm or less; nutlets straight 11

11(10) Mature inflorescence densely-flowered and broad (>1 dm broad); northeastern NM ..... C. thyrsiflora
-- Inflorescence fewer-flowered and narrower; northwestern NM ..... C. bakeri

12(1) Nutlet margins decidedly winged ..... C. pterocarya
-- Nutlet margins rounded or sharply angled, never winged 13

13(12) Taproot charged with red-purple dye, gynobase elongate, surpassing the nutlets and terminated by a sessile stigma, without a differentiated style; fruiting calyx persistent ..... C. micrantha
-- Taproot without red dye (sometimes dye-stained in C. recurvata); gynobase shorter than the nutlets and topped by a definite style that may or may not surpass the nutlets; fruiting calyx deciduous 14

14(13) Usually a solitary nutlet matured in each calyx 15
-- Nutlets normally 4/calyx (often fewer by abortion) 16

15(14) Calyx lobes and nutlet decidedly recurved or deflexed; nutlet muricate ..... C. recurvata
-- Calyx and nutlet not curved or bent; nutlet smooth ..... C. gracilis

16(14) Nutlets in each calyx all smooth surfaced ..... C. fendleri
-- Nutlets all rough 17

17(16) Nutlets decidedly heteromorphic, 1 larger and/or differently ornamented than the others 18
-- Nutlets all alike in size and surface ornamentation 20

18(17) Odd nutlet <1.5 mm long; nutlet margins angled; style surpassing odd nutlet; midrib of fruiting calyx lobes moderately thickened but not noticeable expanded and hard ..... C. angustifolia

-- Odd nutlet 2-3 mm long; nutlet margins rounded; style subequal to odd nutlet; midrib of fruiting calyx lobes conspicuously thickened and bony 19

19(18) Cymes bracteate (most flowers subtended by small, leafy bracts) ..... C. minima
-- Cymes naked (may have 1 or 2 small bracts near the base) ..... C. crassisepala

20(17) Style surpassing the mature nutlets 21
-- Style subequal to the mature nutlets tips 23

21(20) Cymes bractless or nearly so; nutlet scar subulate and expanded at the base to a small, shallow triangular opening .... C. pusilla
-- Cymes bracteate throughout; entire nutlet scar a deeply excavated, triangular opening 22

22(21) Plants low (5-15 cm), stems dichotomously branching from the base outward; spring-fllowering .... C. mexicana
-- Plants taller (15-40 cm), stems initially straight and erect, forming a central axis and producing dichotomously branching laterals; late summer-flowering ..... C. albida

23(20) Stems erect, spreading hirsute, branches erect or ascending ..... C. barbigera
-- Stems strigose, erect, or often flexuous and laxly branched ..... C. nevadensis

Cryptantha albida (H.B.K.) I.M. Johnst. Branched cryptantha [C. ramosa (Lehm.) Greene, Myosotis albida H.B.K.]. Annual; STEMS 1-few from the base, forming a central axis, then paniculately branching above with dichotomously branching laterals, 15-40 cm tall, becoming somewhat woody below with age, antrorsely strigose and sparingly hispid; LEAVES spatulate to linear spatulate, usually folded, abundant along the stems, dorsal surface hirsute, ventral surface sparsely strigose to nearly glabrous; INFLORESCENCE terminating the main stem and lateral branches with single (rarely paired), bracteate cymes; FLOWERS nearly sessile; fruiting calyx to 3 mm long, segments lanceolate, conivent, unequal, pungent-hispid; corolla white, small (<2.5 mm wide); style surpassing mature nutlets; nutlets usually 4, all alike, triangular-ovate, about 1 mm, tuberculate, scar triangular, occupying much of the ventral surface, excavated.

Rarely collected in New Mexico (Chaves, Eddy and Otero Counties) on desert limestones; Mexico and s. Ariz. to w. Tex., and amphitropically distributed to nw. Argentina. Aug-Oct.

Cryptantha angustifolia (Torr.) Greene Narrowleaf cryptantha [Eritrichium angustifolium Torr.,

Krynitzkia angustifolia (Torr.) A. Gray]. Annual; STEMS diffusely branched from the base, 5-20 cm tall, strigose and spreading hispid; LEAVES scattered, linear, strigose and spreading hispid with pustulate hairs; INFLORESCENCE terminating the branches, cymes usually paired, naked or sparsely bracteate at the base; FLOWERS nearly sessile; fruiting calyx 2.5-4 mm long, segments subequal, moderately thickened and spreading hispid; corolla white, small, <2.5 mm wide; style usually surpassing all the nutlets; nutlets lanceolate, usually 4, heteromorphic, the nutlet in the abaxial position more firmly attached and slightly larger (<1.5 mm long) than the other 3 (about 1 mm), all finely tuberculate, odd nutlet margins sharply angled, well defined by a raised edge (but not winged), scar subulate, closed or narrowly open. Occasional in Larrea desert of Doña Ana, Hidalgo, Luna and Otero Counties; s. Calif. and s. Nev. to w. Tex. and n. Mexico. Mar-May.

Cryptantha bakeri (Greene) Payson Baker's cryptantha [Oreocarya bakeri Greene]. Biennial or short-lived perennial; STEMS simple, 1-few from the base, 1-4 dm tall, spreading hispid and softer, finer under-pubescence; LEAVES oblanceolate or spatulate, spreading hirsute and sericeous strigose or long-spreading villous, cauline leaves ascendingly reduced; INFLORESCENCE elongate-cylindric in flower (interrupted below), setose-hirsute, somewhat spreading in fruit, foliar bracts evident, often longer than the individual cymules; FLOWERS homostylic; short-pedicled (1-3 mm); fruiting calyx strigose-hirsute, 6-9 mm long; corolla white with yellow fornices, tube equal or subequal to tips of calyx lobes, limb 7-10 mm wide; nutlets usually 4, rugose-tuberculate on both surfaces, scar closed with conspicuously raised margins.

Sandstones or sandy clay soils in piñon-juniper and Artemisia zones along the northern boarders of Rio Arriba and San Juan Counties; w. Colo. and e. Utah. May-Jun. n=12.

Cryptantha barbigera (A. Gray) Greene Bearded cryptantha [Eritrichium barbigerum A. Gray, Krynitzkia barbigera A. Gray]. Annual; STEMS erect, 1-4 dm tall, freely branched from the base and above when well developed, bristly-hirsute with some of the shorter hairs being appressed; LEAVES oblong to lance-linear, hirsute and obviously pustulate; INFLORESCENCE terminating the branches with naked, paired cymes (rarely solitary or ternate); FLOWERS nearly sessile, fruiting calyx 5-8 mm long, segments lance-linear, subequal with recurved tips and white- villose margins, midrib hirsute; corolla inconspicuous, 1-2 mm wide; style nearly equal to mature nutlet tips; NUTLETS 1-4 maturing/calyx, lanceolate, all alike, 1.5-2.5 mm long, densely verrucose-muricate, scar closed above, gradually dilated towards the basal triangular areola.

Sandy soils or rocky areas in desert scrub of Doña Ana, Grant, Hidalgo and Luna Counties; s. Calif. and s. Nev. to Baja Calif. and nw. Chihuahua. Mar-May. n=12.

Cryptantha cinerea (Torr.) Cronq. Bow-nut cryptantha [C. jamesii (Torr.) Payson]. Perennial (rarely appearing biennial) STEMS 1-several from a branching, often woody caudex, simple or branched, strigose (sometimes loosely villose), with or without varying amounts spreading bristly hairs, or glabrate; LEAVES oblanceolate to lance-linear, obtuse to acute, strigose to villose-puberulent or glabrate; INFLORESCENCE narrow or somewhate broad, foliar bracts subtending individual cymules (at least below), cymules often elongating at maturity; FLOWERS homostylic; pedicles 1-3 mm long; calyx segments ovate-lanceolate, tomentose to strigose-hirsute, 5-7 mm long in fruit; corolla white with yellow (rarely white or pale green) fornices, limb 4-8 wide, tube equal to calyx and ringed with short (<1 mm) antrorse scales at the interior base; NUTLETS 1-4 maturing, 1.8-2.5 mm long, smooth and shiny (often minutely papillate-velvety on the ventral surfaces), deeper than wide, dorsal surface narrowly ovate, bowed outward from the base and inward to the tip, scar closed and discontinuous with a small basal pocket.

This species is related (by nutlet form) to C. palmeri, C. paysonii and C. oblata. At one time, all were

collectively placed into the genus Hemisphaerocarya A. Brand. The later two are distinguished by longer corollas and rugose nutlets. All three lack the interior basal tube scales that are present in C. cinerea.

Cryptantha cinerea is a variable and complex species that occurs in most dry habitats from ponderosa pine forest down to grasslands and desert scrub. The only well marked and consistent variation here is var. pustulosa, which if based upon just the New Mexico populations, could legitimately be considered a separate species. Several authors have unsuccessfully tried to correlate a number of characteristics into recognizable varieties. Few of these are consistent or regionally well circumscribed, and do not account for much of the variation seen here. A thorough review of this species is needed. With some reluctance, the following varieties are recognized in New Mexico:

1. Upper leaf surface glabrous, plants entirely restricted to gypsum habitats ..... var. pustulosa
-- Upper leaf surface pubescent, plants not usually on gypsum 2

2. Stems simple, not branched above the base ..... var. cinerea
-- Stems branched from the base as well as above 3

3. Leaves basal and cauline, oblanceolate or spatulate .. var. jamesii
-- Leaves entirely cauline, acute and nearly linear ..... var. laxa

Var. cinerea [Oreocarya cinerea (Torr.) Greene, C. jamesii var. cinerea (Torr.) Payson, C. jamesii var. setosa (Jones) Johnst. ex Tidestr., O. multicaulis (Torr.) Greene, C. jamesii var. multicaulis (Torr.) Payson,]. A distinctly heterogenous taxon loosely held together by the characteristic of simple stems arising from basal leaves. Pubescence is quite variable. The tall plants with spreading-hirsute stems have been transferred here from C. jamesii var. multicaulis. There is a very short, caespitose form with a thick, woody caudex and finely strigose leaves on central New Mexico limestones that could be placed in a variety setosa. However, it grades into taller plants with similar leaves from other sedimentary and igneous substrates. Variety cinerea is common in some form throughout most New Mexico counties; Utah to Okla. then s. to n. Chihuahua. Apr-Oct. n=12.

Var. jamesii Cronq. [C. jamesii (Torr.) Payson var. jamesii, Eritrichium jamesii Torr., Krynitzkia jamesii (Torr.) A. Gray, Oreocarya disticha Eastw., C. jamesii var. disticha (Eastw.) Payson, Myosotis suffruticosa Torr., O. suffruticosa (Torr.) Greene]. Also a variable taxon distinguished only by its branched stems and relatively broad basal and cauline leaves. Occasional throughout most counties in the northern half of New Mexico and sporadic in the southeastern plains; Nev. to Ariz. and Colo. May-Sep. n=12.

Var. laxa (Macbr.) Higgins [C. jamesii var. laxa (Macbr.) Higgins, Oreocarya suffruticosa var. laxa Macbr.] This is the branched-stem form that replaces var. jamesii in the central and southeastern parts of the state, and adjacent w. Tex and n. Chihuahua. It is distinguished by its slender-acute cauline leaves with uniform strigose pubescence, and lacks basal leaves. The type collection (from northern Chihuahua) has elongate, lax cymules. This form occurs in Doña Ana County, but plants with similar foliage and shorter cymules are common on sandy soils through central and southeastern New Mexico. Jun-Oct.

Var. pustulosa (Rydb.) Higgins [C. pustulosa (Rydb.) Payson, C. jamesii var. pustulosa (Rydb.) Harrington, Oreocarya pustulosa Rydb.]. This unique variety has dark green herbage and is nearly

glabrous, except in the inflorescence. It usually lacks a basal leaf tuft. The New Mexico populations are confined to gypsum substrates in Cibola, Sandoval, Santa Fe, Socorro, and Valencia Counties. Also distributed to the Four-Corners area of ne. Ariz., sw. Colo., and se. Utah, where it reported to occur on sandy soils. May-Oct. n=12.

Cryptantha crassisepala (Torr. & Gray) Greene Thicksepal cryptantha. Annual; STEMS branched from the base, 5-15 cm long, spreading or erect without a strong central axis, spreading- hirsute; LEAVES basal and cauline, linear to narrowly oblanceolate, finely strigose and stiffly hispid, pustulate; inflorescence terminating the branches, cymes naked, solitary (rarely paired); FLOWERS nearly sessile; fruiting calyx 4-6.5 mm long, segments narrowly lanceolate, hirsute and spreading pungent-hispid, midribs becoming thick and hard at maturity; corolla white, limb 1-6 mm wide; style surpassed by odd nutlet; NUTLETS lance-ovate, usually 4, heteromorphic, one evidently larger (2-2.5 mm) and more firmly attached to the gynobase, minutely granulate or muricate; the 1-3 consimilar nutlets are readily deciduous, 1.2 -1.8 mm long and granulate- tuberculate, scar open and commonly excavated.

1. Corolla limb 3.5-6.0 mm in diameter ..... var. crassisepala
-- Corolla limb <3.5 mm in diameter ..... var. elechantha

Var. crassisepala [Eritrichium crassisepalum Torr. & Gray, Krynitzkia crassisepala (Torr. & Gray) A. Gray]. This variety has an evident corolla and slightly larger anthers than var. elechantha, which may indicate it is not entirely reliant on autogamous reproduction. Endemic to sandy soils in the Pecos River counties of west Texas and barely enters southeastern New Mexico (Eddy County). Mar-May.

Var. elechantha I.M. Johnst. The corolla of this variety is typically minute (1-2 mm in diameter). There are, however, sporadic populations in Rio Arriba and McKinley Counties (and possibly elsewhere) that have larger, evident corolla limbs up to 3.5 mm broad, which tends to obscure the distinction between varieties. The small-flowered var. elechantha is our common form occurring throughout the plains and deserts in the western and central two-thirds of New Mexico, and is sporadic in some eastern counties; s. Utah and s. Colo. to Ariz., w. Tex. and n. Chihuahua. Mar-May.

Cryptantha fendleri (A. Gray) Greene Fendler's cryptantha [Krynitzkia fendleri A. Gray - Type from near Santa Fe, C. pattersonii (A. Gray) Greene]. Annual; stem solitary or occasionally branching from the base, 1-4 dm tall, erect and forming a central axis that is paniculately branched above with rigid ascending branches, strigose and spreading-hirsute; LEAVES mostly cauline, linear-acute, hirsute and spreading-hispid, pustulate; inflorescence broad, cymes naked, terminating the stem and branches; FLOWERS sessile or nearly so, fruiting calyx 4-6 mm long, subciliately strigose and pustulate hispid, corolla minute (1 mm wide), white; style subequal to mature nutlets; NUTLETS all alike, usually 4 maturing, narrowly lanceolate, smooth and shinning, scar closed except at the small basal areola.

Irregularly distributed on deep sandy soils from juniper savanna up to ponderosa pine forest in north-central to west-central counties; Utah, Colo., then n. to Sask. and Alta. Jul-Sep.

Cryptantha flava (A. Nels.) Payson Yellow cryptantha [Oreocarya flava A. Nels., O. lutescens Greene]. Caespitose perennial; STEMS several, simple, 1-4 dm tall, arising from the branches of a woody caudex, spreading hirsute; LEAVES linear-oblanceolate to spatulate, mostly basal and silvery strigose, but cauline leaves usually well developed and spreading hispid; INFLORESCENCE typically elongate and thyrsoid-cylindric, conspicuously yellow setose, foliar bracts inconspicuous above; FLOWERS heterostylic; short pedicled (3-5 mm at maturity); fruiting calyx 9-12 mm long, lobes linear; corolla entirely yellow, tube 9-12 mm long and surpassing the calyx; limb 7-11 mm wide; NUTLETS lance-ovate, 3.4-4.2 mm long smooth and glossy, usually only 1 (sometimes 2) maturing per calyx.

This yellow-flowered plant should not be confused with any other New Mexico species. Sporadic on sandstones and sandy shales in northwestern counties (including Socorro). Common in San Juan County; ne. Ariz., w. Colo., e. Utah, and s. Wyo. Apr-Jun. n=12.

Cryptantha fulvocanescens (S. Wats.) Payson Tawny cryptantha. Caespitose perennial; STEMS few-several, simple, 5-30 cm tall, spreading hispid; LEAVES mostly basal and silvery strigose, cauline leaves usually narrower and spreading hispid; INFLORESCENCE narrow- cylindric to somewhat open at maturity, rarely sub-capitate, conspicuously tawny-setose or (rarely) silvery strigose, foliar bracts inconspicuous; FLOWERS hetero-stylic; pedicles 1-8 mm long at maturity; fruiting calyx 6-13 mm long, lobes linear, hispid to strigose; Corolla limb white, 6-9 mm wide, reflexed after anthesis, fornices yellow, tube white or pale yellow and surpassing the calyx; NUTLETS lance-ovate, 3.1-4.4 mm long, both surfaces muricate often with sharp, setose tips terminating some or all of the murications, usually only 1 (sometimes 2) maturing per calyx, scar closed or only slightly open.

1. Calyx densely hispid-strigose; interior calyx lobe faces strigulose, the green surface partly visible .... var. fulvocanescens
-- Calyx densely strigose and sparsely hispid, interior calyx lobe faces obscured by dense, silvery pubescence ..... var. nitida

Var. fulvocanescens [Eritrichium glomeratum var. fulvocanescens S. Wats. - Type from Santa Fe, E. fulvocanescens (S. Wats.) A. Gray, Oreocarya fulvocanescens (S. Wats.) Greene, O. echinoides M.E. Jones, C. echinoides (M.E. Jones) Payson, C. fulvocanescens var. echinoides (M.E. Jones) Higgins, C. flavoculata sensu Martin & Hutchins non (A. Nels.) Payson]. This variety occurs in piñon-juniper woodland down to sagebrush and desert scrub. Common on shales, clayey sands and gypsum in the northwestern counties. Sporadic out-lying populations occur on gypsum habitats as far south as White Sands (Doña Ana & Otero Counties) and as far east as Guadalupe and De Baca Counties; n. Ariz. and s. Utah. Apr-Jun. n=12.

Var. nitida (Greene) Sivinski [Oreocarya nitida Greene]. The inflorescence of this variety is more silvery strigose and less hispid than var. fulvocanescens. On average, it also has shorter pedicles, longer calyx, more flowers/cymule, and is less likely to have setose tips on the nutlet murications. Artemisia and piñon-juniper zones on sandstones or sandy gypsum of San Juan County; ne. Ariz., e. Utah and w. Colo. May-Jun. n=12.

Cryptantha gracilis Osterh. Slender cryptantha. Annual; STEMS branching when well developed, 1-3 dm tall, strigose and spreading hirsute; LEAVES basal and scattered along the stem, linear or narrowly spatulate, hispid-hirsute, pustulate on lower surface; INFLORESCENCE of few to several naked, compact cymes terminating the branches, not much elongating at maturity; FLOWERS nearly sessile, fruiting calyx 2-3 mm long, densely white or tawny appressed hispid-villose, segments lanceolate; corolla white, minute (about 1 mm wide); mature nutlet surpassing the style; NUTLETS lanceolate, 1.4-2.0 mm long, smooth and shinning, maturing 1 per calyx (rarely 2-3, then unequally developed), scar closed except for small basal areola.

Sandstone ledges or very sandy soils in piñon-juniper and Artemisia zones of northern San Juan County; w. Colo. to se. Calif. then n. to Idaho and Oreg. May-Jun.

Cryptantha mexicana (Brandeg.) I.M. Johnst. Mexican cryptantha [Krynitzkia mexicana Brandeg.]. Annual; STEMS several, branching from the base then repeatedly dichotomously branched outward, lax or ascending, 5-20 cm tall, hispid and sparingly strigose-villose; LEAVES oblong-oblanceolate, ascending hispid and pungent setose, pustulate, gradually reduced up the stem; INFLORESCENCE of

completely bracteate, single or paired cymes; FLOWERS nearly sessile; fruiting calyx 3-4 mm long, segments hispid and villose; corolla white, minute (1-2 mm wide); style barely surpassing the nutlets; NUTLETS all alike, usually 4, triangular-ovate, about 1 mm, tuberculate, scar triangular and occupying much of the ventral surface, excavated.

This species is closely related to C. albida, but differs by its spring blooming period. It is further distinguished by its short, rounded growth form that branches from the base and lacks an extended central axis. Occasional on limestone in Chihuahuan Desert scrub of Chaves, Doña Ana, Eddy, Luna, Otero and Sierra Counties; w. Tex, Coahuila and Nuevo León. Mar-May.

Cryptantha minima Rydb. Least cryptantha. Annual; STEMS several branching from the base and above, erect and ascending, without a strong central axis; 5-15 cm tall, finely strigose and coarsely hirsute; LEAVES basal and cauline, narrowly oblanceolate, gradually reduce up the stem, finely strigose and stiffly hispid; INFLORESCENCE cymes continuously or interruptedly bracteate and terminating the branches; FLOWERS with short pedicles (0.5-1.5 mm); fruiting calyx 4-7 mm long, segments narrowly lanceolate, hirsute and spreading pungent-hispid, midribs becoming thick and hard at maturity; corolla inconspicuous, 1-2 mm wide; style surpassed by odd nutlet; NUTLETS usually 4, lance-ovate, heteromorphic, odd nutlet 2-3 mm long, finely granulate, consimilar nutlets 1.2-1.5 mm long, tuberculate, scar open especially at the base.

This species is very similar to C. crassisepala, but easily distinguish by its bracteate cymes. Occasional on sandy or calcareous soils of dry valleys and ridges in the eastern counties of Eddy, Guadalupe, Harding, Mora, Quay, Roosevelt an Torrance, then w. to Bernalillo County; w. Tex. to Sask. (east of the Rocky Mts.). Apr-Jun.

Cryptantha nevadensis Nels. & Kennedy Nevada cryptantha. Annual; STEMS branching from base and above, 1-4 dm tall, erect or lax, branches often curved or flexuous and spreading, strigose with few spreading hairs; LEAVES linear or nearly so, strigose to sparsely spreading hispid, pustulate; INFLORESCENCE terminating the branches with naked, paired cymes (often ternate or single); FLOWERS nearly sessile, fruiting calyx 6-10 mm long, segments lance-linear, subequal with recurved tips, white ciliate margined, midrib pungent-hispid; corolla white, minute (<2 mm wide); style about equal to or barely surpassing nutlet tips; NUTLETS 1-4 matured/calyx, all alike, lanceolate, 2.0-2.4 mm long, densely verrucose-muricate, scar closed above, gradually dilated towards the basal triangular areola.

This species is closely related to C. barbigera, but is distinguished by its narrower linear leaves, and curved, flexuous stems with strigose pubescence. Occasional on rocky, sandy areas in the Larrea desert of Grant and Hidalgo Counties; to n. Baja Calif., s. Calif., s. Nev, and s. Utah. Mar-May.

Cryptantha oblata (M.E. Jones) Payson Rough cryptantha [Krynitzkia oblata M.E. Jones, Oreocarya oblata (M.E. Jones) Macbr., O. hispidissima sensu Woot. & Standl. non (Torr.) Rydb.]. Perennial; STEMS few to several from base, 1-3 dm tall, simple, strigose and spreading hirsute; LEAVES mostly basal, oblanceo-late to lance-linear, strigose and coarsely appressed setose; INFLORESCENCE short-cylindric to subcapitate, somewhat broadening at maturity; FLOWERS homostylic, short pedicled (1-3 mm); fruiting calyx 8-10 mm long, segments lance- linear, densely setose; corolla white, limb 6-10 mm wide, fornices often white or sometimes pale yellow, tube 6-10 mm long, exceeding or (rarely) subequal to the calyx tips, lacking interior basal scales; NUTLETS usually 4 maturing, 2.5-3.0 mm long, dorsal

surface narrowly ovate, bowed outward from the base and inward to the tip, rugose-tuberculate on dorsal surface, slightly roughened on ventral surface, scar closed.

The longer corolla tube lacking basal scales and roughened nutlets serve to distinguish this species from C. cinerea. The only consistent difference from C. paysonii is the smaller, homostylic flowers of C. oblata (stamens always in middle of corolla tube). Widely disjunct populations are found on gravelly limestone or caliche soils in De Baca, Doña Ana, Grant, Guadalupe, Hidalgo, Otero, Socorro and Valencia Counties; w. Tex., n. Chihuahua. Apr-Jun. n=12.

Cryptantha palmeri (A. Gray) Payson Palmer's cryptantha [Krynitzkia palmeri A. Gray, Oreocarya palmeri (A. Gray) Greene]. Biennial or short-lived perennial; STEMS simple, 1 to few from the base, 1.5-4.0 dm tall, spreading setose; LEAVES basal and cauline, lanceolate to lance- linear, strigose and subtomentose; INFLORESCENCE cylindric to broad ovate, cymules elongating at maturity, foliar bracts somewhat conspicuous; FLOWERS homostylic, short pedicled (1-3 mm); fruiting calyx 8-10 mm long, segments lanceolate, setose-hispid; corolla white, fornices yellow, tube 4-6 mm long, equal to calyx, lacking interior basal scales; NUTLETS usually 4 maturing, 2.5-2.8 mm long, narrowly ovate, bowed outward from the base and inward to the tip, smooth and glossy, margins sharply angled, scar closed.

This species is best distinguished from C. cinerea by its larger calyx and lack of scales in the interior base of the corolla tube. Limestone and gypsum breaks of lower Pecos River basin in Chaves and Eddy Counties; w. Tex., Coahuila and Nuevo Leon. May-Jun.

Cryptantha paradoxa (A. Nels.) Payson Paradox cryptantha [Oreocarya paradoxa A. Nels.]. Caespitose perennial; STEMS few to several from a branching caudex, simple, 5-15 cm tall, spreading hirsute; LEAVES mostly basal with fine-strigose pubescence, cauline leaves reduced, more loosely villose; INFLORESCENCE short-cylindric to subcapitate, foliar bracts inconspicuous; FLOWERS heterostylic; short-pedicled; fruiting calyx 6-8 mm long; corolla white, limb 9-12 mm wide, fornices yellow, tube prominently surpassing the calyx; NUTLETS usually 4 maturing, lance-ovate, 2.0-2.8 mm long, rugose-tuberculate, scar narrowly open.

Rare on shaley or silty sandstone with Atriplex in northwestern San Juan County; e. Utah and more frequent in w. Colo. where it is often associated with gypsum habitats. Apr-Jun.

Cryptantha paysonii (Macbr.) I.M. Johnst. Payson's cryptantha [Oreocarya paysonii Macbr. - Type from limestone hills near Berenda Creek, Sierra County]. Perennial; STEMS simple, few to several from base, 1-3 dm tall, strigose and spreading hirsute; LEAVES mostly basal, oblanceolate, strigose and appressed setose; INFLORESCENCE short cylindric or subcapitate, cymules not much elongating at maturity, foliar bracts inconspicuous; FLOWERS heterostylic, short pedicled (1-3 mm), fruiting calyx 8-10 mm long, segments linear-lanceolate, densely setose; corolla surpassing the calyx, limb white and 10-14 mm wide, fornices broad and bright yellow, tube yellow at throat, 12-14 mm long, lacking basal scales; NUTLETS usually 4 maturing, dorsal surface narrowly ovate, 2.5-3.0 mm long, bowed outward from base and inward to tip, finely rugose-tuberculate on both dorsal and ventral surfaces, scar closed.

A very showy species. It is similar to C. oblata, but has larger heterostylic flowers. Widely disjunct populations are found on gravelly-calcareous or gypsum soils from juniper savanna down to desert scrub in De Baca, Doña Ana, Eddy, Lincoln, Otero, Sierra, Socorro and Valencia Counties; adjacent w. Tex. Apr-Jun. n=12.

Cryptantha pterocarya (Torr.) Greene Wing-nut cryptantha. Annual; STEMS freely branching when well

developed, erect, 1-4 dm tall, strigose; LEAVES scattered, linear or nearly so, hirsute, pustulate; INFLORESCENCE terminating branches with naked, paired cymes (rarely solitary or ternate); FLOWERS nearly sessile; fruiting calyx 4-5 mm long, segments lanceolate- ovate, strigose and often sparsely hispid; corolla white, minute (0.5-2 mm wide); style subequal to nutlet tips; NUTLETS usually 4, all alike or heteromorphic, 2.2-3.2 mm long, all (or only 3) conspicuously wing-margined, body surface verrucose-muricate, scar narrowly open above and dilated below to an excavated areola.

1. Nutlets decidedly heteromorphic: 3 winged, 1 lanceolate and wingless ..... var. pterocarya
-- Nutlets alike: all 4 winged ..... var. cycloptera

Var. cycloptera (Greene) Macbr. [C. cycloptera Greene, Krynitzkia cycloptera Greene]. This is the common variety of Larrea zones in the southwestern counties of Doña Ana, Grant, Hidalgo, Luna, Sierra and Socorro, but rare in northwestern New Mexico (San Juan County); s. Calif., s. Nev. s. Utah and n. Mexico. Mar-May.

Var. pterocarya [Eritrichium pterocaryum Torr., Krynitzkia pterocarya (Torr.) A. Gray]. The winged nutlets are deciduous, while the wingless nutlet is more firmly attached to the gynobase and dispersed with the calyx. Sandy soils beneath juniper trees or desert scrub in San Juan County, sporadic in southern New Mexico (Doña Ana and Grant Counties); w. Colo., Ariz., s. Calif., Utah to e. Wash. and sw. Idaho. Apr-May.

Cryptantha pusilla (Torr. & Gray) Greene Low cryptanhta [Eritrichium pusillum Torr. & Gray, Krynitzkia pusilla (Torr. & Gray) A. Gray]. Annual; STEMS few to several from the base, slender, spreading to ascending, 3-15 cm long, strigose to spreading hirsute; LEAVES mostly basal, scattered above, linear-spatulate, hispidulous and pustulate; INFLORESCENCE terminating branches, cymes solitary or geminate with few (if any) minute bracts, elongating at maturity; FLOWERS nearly sessile, fruiting calyx 2-2.5 mm long, broadly ovate, segments lance- ovate; corolla white, minute (<1 mm wide); style usually surpassing nutlets; NUTLETS all alike, usually 4 maturing, about 1 mm long, triangular-ovate, bent, tuberculate, margins sharply angled, scar subulate and dilated at base into a triangular areola.

Desert scrub on rocky, gravelly slopes in Doña Ana, Hidalgo, Luna and Sierra Counties; s. Ariz, w. Tex., Chihuahua, Durango and Sonora. Mar-May. n=9.

Cryptantha recurvata Coville Bent-nut cryptantha. Annual; STEMS freely branching when well developed, lax and spreading or ascending, 1-4 dm long, strigose; LEAVES scattered, linear to lance-oblong, appressed-hispid and minutely pustulate; INFLORESCENCE terminating branches with naked, usually paired cymes, elongating at maturity; FLOWERS sessile; fruiting calyx 2.5-3.5 mm long, asymmetrical, bent and recurved, strigose and usually sparsely spreading hispid; corolla white, minute (about 1 mm wide); style surpassed by nutlet tip; NUTLETS only 1 matured/calyx, somewhat recurved-bent in alignment with the calyx, finely granulate-muricate, scar closed or narrowly open.

Immediately distinguishable from other species by its recurved-bent calyx. Infrequent in piñon-juniper, Artemisia or Atriplex communities in San Juan County; adjacent Ariz., Colo. and Utah to s. Calif., Nev. and Oregon. Apr-Jun.

Cryptantha setosissima (A. Gray) Payson Bristly cryptantha [Eritrichium setosissimum A. Gray, Oreocarya setosissima (A. Gray) Greene]. Biennial; stem simple and solitary from a stout taproot, 4-10 dm tall, finely puberulent and coarsely spreading-setose with long (2-4 mm) bristles; LEAVES basal and

cauline, oblanceolate, villose-tomentose with pustulate subappressed setae, gradually reduced above; INFLORESCENCE densely setose, narrow-cylindric and interrupted below when in flower, open in fruit with cymules elongating at maturity, foliar bracts evident at least below; FLOWERS homostylic; fruiting calyx 6-13 mm long, hispid; corolla white with yellow fornices, limb 7-10 mm wide, tube equal with calyx; NUTLETS usually 4 maturing, 4.5- 6.0 mm long, margins decidedly papery-winged, dorsal body surface finely muricate; scar narrowly open.

This tall, coarse biennial with winged nutlets is easily recognizable, but rarely seen in New Mexico. Dry meadows and open slopes in the montane forests of Catron and San Juan Counties; adjacent Ariz. to c. Utah and s. Nev. Jul-Aug.

Cryptantha thyrsiflora (Greene) Payson Plains cryptantha [Oreocarya hispidissima (Torr.) Rydb. pro parte, O. urticacea Woot. & Standl. - Type from Cañoncito, Santa Fe County]. Biennial or short-lived perennial (usually monocarpic); STEMS stout, 1-few from basal rosette, 2-4 dm tall, densely spreading hispid; LEAVES mostly basal, oblanceolate, hispid and pustulate; INFLORESCENCE broad (1-2.5 dm wide) at maturity, dense and diffuse with numerous elongating cymules, hispid, foliar bracts evident; FLOWERS monostylic, fruiting calyx 7-9 mm long, segments linear, tawny-setose; corolla white, fornices yellow, limb 4-8 mm wide, tube equal to calyx, interior basal scales present; NUTLETS 1-4 maturing/calyx, lanceolate, 2.5-3.5 mm long, dorsal surface rugose-tuberculate, ventral surface less so, margins angled, scar narrowly open.

Dry canyons and rocky outcrops from ponderosa pine forest down to short-grass prairie in the northeastern counties of Colfax, Harding, Mora, San Miguel, Santa Fe and Union; Okl.-Tex. panhandles to w. S. Dak. and w. to the Rocky Mts. Jul-Aug. n=12.

New Plant Distribution Records

New records for New Mexico are documented by the county of occurrence and the disposition (herbarium) of a specimen.

— Thomas Adams (Range Science Herbarium, Box 3-I, New Mexico State University, Las Cruces, NM 88003)
Aira elegans Willd. ex Kunth (Poaceae): Doña Ana Co. (NMCR) [weakly adventive].

— Kelly Allred (Range Science Herbarium, Box 3-I, New Mexico State University, Las Cruces, NM 88003)
Catapodium rigidum (L.) C.E. Hubb. (Poaceae): Doña Ana Co. (NMCR) [weakly adventive].

— David Lee Anderson (DES-E, Bldg T-150, White Sands Missile Range, NM 88002)
Machaeranthera gypsopila B.L. Turner (Asteraceae): Socorro Co. (TEX, WSMR).

— Adam Forbes (Range Science Herbarium, Box 3-I, New Mexico State University, Las Cruces, NM 88003)
Cardamine hirsuta L. (Brassicaceae): Doña Ana Co. (NMCR) [weakly adventive].
Briza minor L. (Poaceae): Doña Ana Co. (NMCR) [weakly adventive].

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Worthington, R.D. 1998. Inventory of the flora of the Florida Mountains, Luna County, New Mexico. El Paso Southwest Botanical Mescellany No. 4. [available from the author]

Rare, Threatened, and Endangered Plants:

[There are numerous reports and discussions concerning rare New Mexico plants on the New Mexico Rare Plant Technical Council web site: http://biology.unm.edu/~chelo/nmrptc1.html]

Colorado Rare Plant Field Guide available from Susan Spackman, Colorado Natural Heritage Program, 254 General Services Bldg., Fort Collins, CO 80534. (970) 491-1309 [donation requested for shipping costs]

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New Mexico Naturalist's Notes. P. Knight & R. Sivinski, eds. Sponsored by Marron & Associates, Inc. 7809 Fourth St. NW, Albuquerque, NM 87107. (505) 898-8848. [New journal devoted to New Mexico checklists, field observations, ecologic notes, habitat descriptions, and other valuable information that normally would not be published in the usual botanical journals. Available in all state libraries, or from Paul Knight while supplies last.]

The Plant Press. Department of Botany and the U.S. National Herbarium. Gratis. Contact Shirley Maina, National Museum of Natural History, Smithsonian Institution, Dept. Botany, NHB 166, Washington, DC 20560. email: maina.shirley@nmnh.si.edu v

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The New Mexico Botanist

Number 9 **August 3, 1998**

A Newsletter for the flora of New Mexico, from the Range Science Herbarium and Cooperative Extension Service, College of Agriculture and Home Economics, New Mexico State University.

In This Issue —

A Key to the Penstemons of New Mexico

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The key to New Mexico's penstemons in Nisbet & Jackson (1960) has been out of date for some time and Martin & Hutchins's (1980) rearrangement of that work was no improvement. My goal has been to create a beefed-up key to the beardtongues of New Mexico that incorporates species new to the state since 1960 and nomenclatural changes. This work is not revisionary, I have simply utilized the literature and the UNM and ASU herbaria. When time allows, other appropriate herbaria will be visited to gather more information to revise the key if necessary.

Before a key can be made, one must know all the taxa in the state. I used Nisbet & Jackson (1960) as the starting point. They treated 41 taxa, not including a *P. ambiguus* x *thurberi* hybrid. A list of New Mexico plants compiled by the Soil Conservation Service (1994) contained 48 taxa, seven of which were new state records. These are *P. angustifolius* var. *venosus*, *P. comarrhenus*, *P. deaveri*, *P. lentus*, and the closely related trio of *P. griffinii*, *P. inflatus*, and *P. pseudoparvus*, which were split from *P. oliganthus* by Crosswhite (1965). I have seen New Mexico specimens of all of them at UNM and/or SJNM. Heflin (1997) added one more species, *P. cobea*. I found two additional species in the cabinets at UNM, *P. grandiflorus* and *P. virgatus* var. *asa-grayii*, which brings the total to 51 known *Penstemon* taxa for New Mexico.

There are still questions concerning the identification, presence, and distribution of certain penstemons in New Mexico. The UNM herbarium has few if any specimens of several taxa. ASU has specimens of some of these taxa whose distributions are centered west of here. San Juan College (SJNM) contains a number of specimens from that part of the country. In addition, *P. linarioides* vars. *compactifolius* and *maguirei* and *P. metcalfei* have incomplete descriptions in the literature making it hard to see how they fit into the existing framework. Additional information is needed for these plants:

Penstemon angustifolius venosus UNM: no specimens; ASU: no NM specimens; SJNM: a few specimens from San Juan County, New Mexico.

Penstemon campanulatus (*P. pulchellus*) UNM: no specimens; ASU: no specimens; SJNM: no specimens.

Penstemon comarrhenus UNM:one specimen; ASU: no NM specimens; SJNM: one specimen from Rio Arriba and two from San Juan counties, New Mexico.

Penstemon dasyphyllus UNM: two specimens from Hidalgo county, NM, and two from Arizona (Cochise and Pima counties); ASU: none from NM, a few specimens from Cochise, Santa Cruz, and Gila counties, AZ; SJNM: no specimens.

Penstemon eatonii UNM: no specimens; ASU: no NM specimens; SJNM: one specimen from San Juan County, NM.

Penstemon lentus UNM: one specimen from McKinley county; ASU: one specimen from San Juan county, NM, a few specimens from Apache and Navajo counties, AZ; SJNM: one from San Juan County, NM, a few from nearby parts of Colorado and Utah.

Penstemon linarioides vars. *compactifolius* and *maguirei* UNM: no specimens; ASU: no specimens; SJNM: no specimens.

Penstemon metcalfei (*P. puberulus*) UNM: no specimens; ASU: no specimens; SJNM: no specimens.

The status of *Penstemon ramosus* Crosswhite, *P. lanceolatus* Benth., and *P. metcalfei* Woot. & Standl. is up in the air. According to Crosswhite (1966), the plant known as *P. lanceolatus* to New Mexico authors is actually *P. ramosus*. True *P. lanceolatus* Bentham is not known to occur in New Mexico; its nearest location is apparently Big Bend, TX. However, Straw (1997) believes the two taxa to be conspecific, *P. ramosus* being a synonym of *P. lanceolatus*, making the latter a rather widespread species in northern Mexico extending into southwestern New Mexico and southeastern Arizona. Two specimens at UNM, originally labeled *P. lanceolatus*, were misidentified, one is *P. jamesii* and the other *Castilleja* sp. I saw two specimens of *P. ramosus* at ASU: one from Rockhound State Park, Luna county, NM and the other from Cochise county, AZ, near Portal.

Penstemon metcalfei is a mystery to me. It was described in 1909 by Wooton & Standley (I have not seen this document). In the same year they described *P. puberulus*, which they later put into synonymy under *P. metcalfei* in their Flora of New Mexico (Wooton & Standley 1915). In the original description of *P. puberulus*, which I have seen and is very incomplete, they indicated that it was closely related to *P. whippleanus*. Keck (1945) agreed and subsumed *P. metcalfei* (actually a "new name for *P. puberulus*") and *P. puberulus* under *P. whippleanus*. Nisbet & Jackson

(Continued on page 2, Penstemon)

Botanice est Scientia Naturalis quae Vegetabilium cognitiorem tradit.
— Linnaeus

(Penstemon, Contmued from page 1)

(1960) followed suit. What is implied (but not stated in the descriptions I have read) is that *P. metcalfei*'s inflorescence is glandular and, more importantly, that the anthers are explanate as they are in *P. whippleanus*. All this seems straight forward. However, without documentation, *P. metcalfei* is treated as a distinct species in Heflin's new book [see a review in this issue-ed.]. The text states that *P. metcalfei* is a member of the Oliganthi Alliance that Crosswhite (1965) worked on. However, the anthers in members of this group are not explanate. The purported photograph of *P. metcalfei* looks more like *P. oliganthus* than *P. whippleanus*, but the anther dehiscence is not clearly visible. I have not seen the original description of *P. metcalfei* (which may help) or any specimens, so I am unable to make a judgement. To clear up the confusion will require study of the type material and other specimens, if any, as well as more field work. Consequently, I treat *P. metcalfei* as a synonym of *P. whippleanus* in this key until more information is available.

Three plants that have been suggested as being present in New Mexico are not likely. *Penstemon heterophyllus* Lindl. is listed in USDA (1997) for New Mexico, but it is found only in central California (Keck 1932). *Penstemon heterophyllus* S. Wats., a synonym of *P. sepalulus* A. Nels., is a central Utah endemic (Cronquist et al.). *Penstemon parryi* (Gray) Gray grows in Arizona and northern Mexico (Sonora). *Penstemon parviflorus* Pennell, collected once near Mancos, Colorado, in late 1800s by Alice Eastwood, has not been found since and apparently never was present in New Mexico.

A penstemon that may be found in southwestern New Mexico is *P. stenophyllus* Gray, which occurs in extreme southeastern Arizona and north-central Mexico, very near New Mexico's boot heel (Crosswhite 1966).

Although many of the state's penstemons are readily identifiable, some closely related species may cause problems.

The differences among *P. strictus*, *P. comarrhenus*, and *P. strictiformis* are not always as distinctive as one would like. The important characters are the inflorescence architecture, calyx size and shape, flower color, degree and type of anther vestiture, and amount of bearding on the staminode, unfortunately all of which are variable within a taxon. The centers of their distributions are mostly separate, but there seems to be some overlap in the northwestern part of the state.

The character differences among the members of the Oliganthi Alliance (*P. griffinii*, *P. inflatus*, *P. oliganthus*, and *P. pseudoparvus*) are subtle and variable. The identification of a taxon is sometimes strongly influenced simply by where it was collected. Inspection of specimens at UNM has shown that *P. oliganthus* (s.s.) exists in Catron and Socorro counties, between the White Mountains of east central Arizona (Apache county) and the Mount Taylor area in New Mexico, the two centers of distribution known to Crosswhite (1965). In addition both *P. oliganthus* and *P. pseudoparvus* are now known to grow in the Magdalena Mountains.

The subspecies of *Penstemon barbatus* are not always distinguishable particularly in certain counties. The bearding at the base of the lower corolla lobes is variable in quantity and color, but the differences in the calyx lobe length usually help to distinguish them.

Two glaucous plants, *Penstemon lentus* and *P. secundiflorus*, are very similar, although apparently allopatric. They differ in the inflorescence architecture and in the calyx.

The principal feature distinguishing *P. linarioides* from *P. crandallii* is vestiture. However, the hairs on some plants don't allow them to be placed easily. Fortunately, the calyces differ and there is little geographical overlap between the taxa.

Rare, in this work, means that the plant is rare in New Mexico. Explanate anthers dehisce completely (including across the connective) and lay out flat (e.g., the *P. jamesii* group, *P. whippleanus*). The anthers of many plants dehisce completely also, but they do not lay out flat (e.g., the Oliganthi Alliance, *P. linarioides*).

United States Postal Service codes are used for states; New Mexico county abbreviations are those used in Sivinski & Lightfoot (1995); counties of other states are indicated by the first two or three letters of their names; MEX = Mexico; tpTX = transPecos Texas, nc = north central, etc.

When collecting penstemons, it is very important to note the glaucescence, fresh flower color, corolla shape, and presence of ridges on the bottom of the corolla floor, in addition to the usual information. Glaucescence is not always apparent in a dried specimen, especially in some that only occasionally exhibit this characteristic. Fresh flower color is an important clue in certain groups. The degree that the corolla expands, the position of the corolla lobes, and the shape of the corolla opening are key characters that sometimes are not well preserved in pressed plants. It is very difficult to detect ridges in the corolla floor in pressed specimens.

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KEY TO *PENSTEMON* IN NEW MEXICO

1 Plants shrubby; leaves linear & < 35 mm long

2 Corolla blue, blue-purple, or reddish purple; 8-14 mm long, all lobes spreading; tube gradually expanded; desert grasslands in sNM (CA, HI, LU), sAZ, sCA, nMEX; Apr-Aug ..... ***P. thurberi*** Torr.

2 Corolla pink externally, 15 24 mm long, white on the face of the lobes; upper lobes reflexed, lower lobes projecting; tube narrow and curved

3 Stems puberulous; sandy soils in eNM (BE, CU, DB, GU, LE, QU, RO, SF, TO, UN), eCO, wTX, wOK; (May) Jun-Jul (Aug) ..... ***P. ambiguus*** Torr. subsp. ***ambiguus***

3 Stems glabrous; sNM (ED, LU, SO), AZ, TX, NV, MEX; Jun-Jul ..... ***P. ambiguus*** Torr. subsp. ***laevissimus*** Keck

(Continued on page 3, Penstemon)

(Penstemon, Continued from page 2)

1 Plants herbaceous or woody only at the base; leaves linear or broader
4 Leaves linear and short (< 35 mm long)
5 Corollas red, 25-32 mm long, tubular, strongly bilabiate; inflorescence secund, glandular; anthers explanate, glabrous; staminode bearded most of length with bright yellow hairs; base of lower lobes with long, flat, yellow hairs; stems woody well above base; leaves small, needlelike, crowded on lower part of stems; rocky areas in swNM (CA, GR, HI, SO), seAZ, nMEX; 5800-10,000 ft; Jun-Aug ..... ***P. pinifolius*** Greene
5 Corollas some shade of blue or purplish; bottom of corolla throat plicate (2-ridged) forming a low palate
6 Stems and leaves puberulous with flat, appressed scalelike hairs, especially on lower leaves (scales much smaller & stems more uniformly retrorsely puberulent in var. *linarioides*); leaves scattered on flowering stems; calyx lobes acute or very short acuminate, scarious margined almost to tip
7 Principal leaves mostly lanceolate to oblanceolate; limestone cliffs; apparently last collected in NM in 1880 (Gila valley, GR), seAZ ..... ***P. linarioides*** Gray subsp. ***nuguirei*** Keck
7 Principal leaves essentially linear; base of lower lobes lightly bearded
8 Staminode sparsely bearded with short hairs, longer golden hairs in apical tuft; base of lower lobes lightly bearded; plants shorter (1-3.5 dm); resembles *P. crandallii glabrescens* in habit; vestiture variable; common in plains & foothills with sagebrush, PJ, oak in nwNM (CI, MC, RA, SJ) & swCO; 5200-8700 ft; Jun-Jul ..... ***P. linarioides*** Gray subsp. ***coloradoensis*** (A.Nels.) Keck
8 Staminode more densely bearded with longer hairs for most of its length; base of lower lobes strongly bearded; plants relatively tall (2-5 dm), scoparioid, stem bases more-or-less woody; common in canyons & foothills in PJ & PIPO in swNM (DA, CA, GR, HI, LU, MC, SI, SO) & seAZ; 4500-6000 ft; Jun Aug ..... ***P. linarioides*** Gray subsp. ***linarioides***
6 Stems and leaves puberulous with fine erect or retrorse hairs, or leaves glabrous; leaves numerous on flowering stems; calyx lobes long acuminate, scarious margined only at base
9 Leaves glabrous ventrally; dry hillsides in nwNM (CO, SA, RA, TA) & sCO; 6900-9000 ft; Jun-Aug ..... ***P. crandallii*** A.Nels. subsp. ***glabrescens*** (Pennell) Keck var. ***glabrescens***
9 Leaves puberulous with fine erect or retrorse hairs; ncNM near Taos (RA, TA) ..... ***P. crandallii*** A.Nels. subsp. ***glabrescens*** (Pennell) Keck var. ***taosensis*** (Keck) Nisbet & Jackson
4 Leaves not linear or if linear, then much longer than 35 mm
10 Upper stem leaves connate perfoliate (upper stem leaves of *P. superbus* sometimes connate-perfoliate, but not serrate); corolla pink to rose, 25-35 mm; leaves usually serrate
11 Corolla expanding gradually, pale pink to rose; staminode glabrous; anthers explanate; plants glabrous, inflorescence glandular; rocky places in PJ/oak & PIPO in swNM (CA, DA, GR, HI), AZ, sNV, nMEX; 4500-7000 ft; Apr-Jun (Aug) ..... ***P. pseudospectablis*** M.E. Jones subsp. ***connatifolius*** (A.Nels.) Keck
11 Corolla expanding abruptly; staminode bearded; anthers explanate or not; plants glaucous, inflorescence glandular; disjunct in NM, but now established in at least two places along I 40; cNM (BE, TO), cAZ & westward; 5000-7000 ft (in NM); May-Jun (in NM) ..... ***P. palmeri*** Gray ssp. ***palmeri***
10 Upper stem leaves sessile or subcordate; corollas various colors (rarely pink to rose or white); leaf margins various
12 Corolla some shade of red but not pink to rose, usually tubular or slightly expanding
13 Corolla constricted at orifice & with long yellow hairs; staminode bearded near tip; anthers minutely spinescent on sutures, opening all but the connective, & minutely puberulent
14 Stem leaves moderately thin, broadly lanceolate, oblong, or lance-ovate, lower ones 10-20 cm long; calyx 3 mm long; rocky areas in PIPO & PSME in scNM only (LI, OT, SO? Capitan, Sacramento, & Oscura (?) Mts); 6600-8800 ft; Jun Jul; RARE ..... ***P. cardinalis*** Woot. & Standl. subsp. ***cardinalis***
14 Stem leaves moderately thick, ovate or subcordate, lower ones 5 6 cm long; calyx 4-6 mm long; rocky areas in chaparral, PJ, & PIPO in seNM (ED, OT), tpTX (Guadalupe Mts of both states); 4500-5500 ft; May Jun; RARE ..... ***P. cardinalis*** Woot. & Standl. subsp. ***regalis*** (A.Nels.) Nisbet & Jackson
13 Corolla not constricted at orifice, with hairs or not; anthers glabrous or not, spinescent on sutures or not
15 Anther sacs dehiscent by a short slit across the connective, the tips remaining closed, U-shaped, sutures spinescent; corolla glandular, strongly bilabiate, upper lip projecting & forming galeate hood, glabrous within; staminode glabrous; sagebrush, PJ, oak, PIPO in wNM (CA), AZ, swCO, sUT, NV, sCA; 5200-9000 ft; (Jun) Jul-Aug (Oct) ..... ***P. rostriflorus*** Kellogg (*P. bridgesii* Gray)
15 Anther sacs completely or partially dehiscent, the tips open
16 Anther sacs explanate
17 Staminode glabrous; foliage not glaucous; corolla bright red; rocky areas in limestone, Sacramento Mts only (DA, OT); 4300-5300 ft; May-Jun; RARE ..... ***P. alamosensis*** Pennell & Nisbet
17 Staminode bearded; foliage strongly glaucous; corolla orange-pink to scarlet; PJ, oak, PIPO in rocky areas & washes in swNM (GR, HI), seAZ, nMEX; 3500-5200 ft; Mar-Jun; RARE ..... ***P. superbus*** A.Nels.
16 Anther sacs not explanate

(Continued on page 4, Penstemon)

Botany is the natural science that transmits the knowledge of plants.

— Linnaeus

(Penstemon,Continued from page 3)

18 Corolla bilabiate but not strongly so, lower lobes short, rounded, usually spreading; throat glabrous
19 Corolla barely bilabiate, almost regular; inflorescence glabrous or puberulent; anthers U-shaped, opening at tips only, minutely puberulent, sutures denticulate; staminode glabrous to slightly bearded at tip; dry slopes & flats in sagebrush, PJ, & PIPO in nwNM (SJ), swCO, UT, AZ; 5000-9200 ft; Apr-Jun (Jul)
..... ***P. eatonii*** Gray subsp. ***undosus*** (M.E. Jones) Keck
19 Corolla definitely bilabiate; inflorescence glandular; anthers opening almost completely, glabrous; staminode glabrous; PJ & PIPO in rocky canyons in swNM (GR, HI, LU), seAZ, nMEX; about 5000 ft; Jun Aug; RARE
..... ***P. ramosus*** Crosswhite (*P. lanceolatus* of NM authors)
18 Corolla strongly bilabiate, lower lobes long, narrow, reflexed, upper lobes projecting; throat usually bearded
20 Base of lower lobes bearded with yellow hairs; calyx lobes 6-10 mm long; PJ, oak, & PIPO in swNM (CA, GR, HI, SI), seAZ, tpTX, nMEX; 5200-10,000 ft; Jun-Sep ..... ***P. barbatus*** (Cav.) Roth. subsp. ***barbatus***
20 Base of lower lobes glabrous or bearded with a few white or yellowish hairs; calyx lobes < 6 mm long
21 Anthers glabrous; dry hillsides in PJ, oak, PIPO; NM (BE, CA, CO, DA, ED, GR, LI, MO, OT, RA, SA, SM, SI, SO, TA, UN), seUT, neAZ; 5200-8200 ft; Jun-Aug (Sep)
..... ***P. barbatus*** (Cav.) Roth. subsp. ***torreyi*** (Benth.) Keck
21 Anthers bearded; dry hillsides in PJ, oak, PIPO in nwNM (CA, CI, MC, RA, SA, SJ, SO), swCO, seUT, neAZ; 5200-8200 ft; Jun-Aug ..... ***P. barbatus*** (Cav.) Roth. subsp. ***trichander*** (Gray) Keck

12 Corolla some shade of blue or purple (rarely white or pink)
22 Foliage glabrous and slightly to heavily glaucous; leaves usually thickened or fleshy; staminode tip expanded
23 Most of the inflorescence bracts prominent; inflorescence compact, not secund, the very short internodes, pedicels, and peduncles giving the effect of a spike of flowers
24 Bracts lance-ovate to orbicular, acute to short acuminate, large, conspecuous, often overlapping, clasping
25 Plants tall (usually 5-10 dm); calyx lobes 7-13 mm long; flowers 35-48 mm long; inflorescence open; corolla pink, bluish lavender, or pale blue, abruptly inflated; sandy to loamy soils in prairies; at western edge of range neNM (UN), also scTX to neWY, ND & IN; about 5100 ft (in NM); Jun ..... ***P. grandiflorus*** Nutt.
25 Plants usually < 5 dm tall; calyx lobes usually < 7 mm long; flowers 14-20 mm long; inflorescence congested; corolla pale lavender-blue; sandy soil in grasslands; eNM (CH, ED, LE, RO), TX, seCO, wKS; 3500-4500 ft; May-Jun
..... ***P. buckleyi*** Pennell
24 Bracts lance-ovate or ovate, smaller, usually caudate; inflorescence congested; corolla sky-blue, violet-blue, or pinkish (often in same inflorescence); [these two subspecies may not be worthy of distinction since only flower color is different]
26 Corollas pale blue to bluish-purple; prairies & hills in nNM (CO, MC, SJ, TA, UN), seCO, wKS, wOK (southern Great Plains); 4000-8500 ft; May-Jun ..... ***P. angustifolius*** Nutt. subsp. ***caudatus*** (Heller) Keck
26 Corollas lavender to pinkish; sandy soils in blackbrush, sagebrush, PJ in nwNM (SJ), seUT, neAZ (Colorado Plateau); 5000-5800 ft; May-Jun ..... ***P. angustifolius*** Nutt. subsp. ***venosus*** Keck
23 Only the lower inflorescence bracts prominent; inflorescences not spikelike, usually open, either ñ to distinctly secund or not; anthers completely dehiscent but not explanate, glabrous, sutures minutely spinescent
27 Inflorescence not secund; bracts broadly ovate with a short, abruptly pointed tip; throat narrow and often somewhat curved, expanded only a the orifice, glabrous at base of lower lobes; prairies & lower mts in NM (CH, DA, DB, GR, GU, HA, HI, LE, LI, LU, MO, QU, SA, SI, SM, SO), swKS, wOK, wTX, seAZ, Chihuahua; about 4000-7000 ft; Apr-Jun
..... ***P. fendleri*** Torr. & Gray
27 Inflorescence at least more-or-less secund, usually distinctly so; bracts lanceolate; throat gradually expanded, usually bearded at base of lower lobes; staminode bearded, tip dilated [the following not always easy to distinguish]
28 Calyx margins broadly scarious, often pinkish or purplish; inflorescence usually strongly secund; pedicels & peduncles usually short; rocky areas in wc,c,nc&neNM (BE, CA, CO, HA, LA, MC, SA, SF, SM, TA, UN), sCO, sWY; 5000-9500 ft; May-Jun ..... ***P. secundiflorus*** Benth.
28 Calyx margins narrowly scarious, usually not colored; inflorescence more-or-less secund; peduncles & pedicels usually elongate; sandy or gravelly soils in sagebrush, PJ, oak, PIPO in nwNM (MC, SJ), seUT, swCO, neAZ; 4900-8500 ft; May-Jun; RARE ..... ***P. lentus*** Pennell
22 Foliage glabrous, puberulent, &/or glandular, but not glaucous; leaves not thickened; staminode tip expanded or not
29 Inflorescence and corollas glandular pubescent externally
30 Fascicles of small, obscurely toothed leaves in axils of stem leaves; corolla abruptly ampliate ventricose, violet to purple color; anthers fully dehiscent but not explanate; staminode dilated distally, yellow bearded; rocky areas at middle elevations in swNM (1II) to scMEX ..... ***P. campanulatus*** (Cav.) Willd. subsp. ***chihuahuensis*** Straw (*P. pulchellus* Lindl.)
30 No fasciculate leaves (fascicles of leaves occasionally present in *P. dasyphyllus*, but then leaves much longer & not toothed and staminode glabrous & not dilated)
31 Anther sacs explanate
32 Corolla dull purple (rarely white), lower lobes projecting, 3-5 mm longer than upper lobes; subalpine to above timberline in NM (BE, CA, LI, MO, RA, SA, SF, SI, TA, TO, VA), AZ, CO, UT, WY, seID, swMT; 8200-11,800 ft; Jun-Aug (Sep) ..... ***P. whippleanus*** Gray (*P. metcalfei* Woot. & Standl., *P. puberulus* Woot. & Standl.?)
32 Corolla white, pale lavender, violet-blue, blue-purple, lower lobes not projecting, not noticeably longer than upper lobes
33 Corolla not bearded at base of lower lobes; staminode sparsely to moderately bearded

(Continued on page 5, Penstemon)

(Penstemon, Continued from page 4)

34 Corolla 1-2 cm long, densely glandular pubescent within and without, white (rarely pale lavender); tube funnelform & moderately inflated; western Great Plains; NM (QU, UN) to TX & sCAN; about 5000 ft; May-Jun ..... ***P. albidus*** Nutt.

34 Corolla 3.6-6 cm long, pale colored, densely glandular pubescent without but glabrous within; tube abruptly inflated; prairies, pastures, hills; escaped in NM (QU, TA) & seCO, native range in NB, MO, AR, OK, eTX; 3800-7200 ft; Apr-Jun ..... ***P. cobaea*** Nutt.

33 Corolla bearded at base of lower lobes; staminode conspicuously bearded

35 Corolla 5-6 mm wide, orifice as high or higher than wide; lower lip not glandular within; staminode not or barely exserted; throat not to moderately inflated; shrub land, PJ in nwNM (MC, SJ), swCO, seUT; 5200-7600 ft; May-Jun ..... ***P. breviculus*** (Keck) Nisbet & Jackson

35 Corolla 8-19 mm wide, orifice much wider than high; lower lip glandular within; staminode usually prominently exserted; throat much inflated

36 Corolla 24-35 mm long, 10-15 mm wide; plains in NM (BE, CO, CU, DB, ED, GU, LI, MO, OT, QU, RO, SA, SF, SM, TO, UN), seCO, swKS, wTX; 4200-8000 ft; May-Jun ..... ***P. jamesii*** Benth.

36 Corolla 14-22 mm long, 8-19 mm wide; wNM (CA, CI, MC, SI, SJ, VA), swCO, nAZ, sUT (Colorado Plateau); 4900-7400 ft; Jun-Aug ..... ***P. ophianthus*** Pennell

30 Anther sacs not explanate

37 Staminode glabrous, not dilated at tip; corolla markedly ampliate; anthers U-shaped, sutures spinescent; leaves occasionally in fascicles; gravelly slopes, desert grasslands in swNM (HI, LU), seAZ, Big Bend, ncMEX; 4500-5700 ft; Jun-Aug ..... ***P. dasyphyllus*** Gray

37 Staminode bearded; corolla narrow to expanded; anthers not U-shaped & not spinescent; leaves never in fascicles

38 Leaves finely toothed; corolla pale lavender to pale violet; corolla floor narrow, 2-ridged; base of lower lobes white hairy; plains in neNM (CO, SM, UN), seCO, to CAN, WI (eastern slope of Rockies); 7000-8700 ft; Jun-Aug ..... ***P. gracilis*** Nutt.

38 Leaves entire or undulate (occasionally denticulate in *P. auriberbis*); corollas darker in color; corolla floor ridged or not, base of lower lobes usually hairy

39 Corolla floor without ridges on under side; base of lower lobes villous; corolla 14-24 mm long, staminode slightly included to distinctly exserted, densely golden bearded for most its length, dilated at tip; bracts leaflike and not much reduced; plains in neNM (CO, UN, barely enters NM) & seCO (common); 4500-7500 ft; May-Jun ..... ***P. auriberbis*** Pennell

39 Corolla floor deeply to moderately ridged on under side; base of lower lobes with a few white or many yellow hairs; staminode usually included, densely bearded for half its length; bracts always reduced and never leaflike

40 Corolla floor deeply 2-ridged; base of lower lobes & floor of corolla and staminode densely covered with golden hairs; corolla 17-25 mm; flowers drooping to horizontal; rocky areas in forests & grasslands in ncNM (RA, TA), scCO; 7000-10,000 ft ..... ***P. griffinii*** A.Nels.

40 Corolla floor less strongly ridged, glabrous; base of lower lobes with a few white hairs; staminode orange-bearded; corolla 11-27 mm; flowers ascending to drooping [these three not always readily distinguishable]

41 Corolla fairly abruptly but moderately inflated, 17-27 mm long; flowers ascending to horizontal; plants robust (1-6 dm); basal rosette usually gone at anthesis; all but uppermost cauline leaves usually well-developed & similar to basal; hillsides & meadows in c&ncNM (BE, CO, SF, SM, TA, TO); 7500-11,000 ft; (May) Jun-Aug ..... ***P. inflatus*** Crosswhite

41 Corolla straight or little inflated, 11-20 mm long; plants smaller (1-4 dm); basal rosette often present at anthesis; basal leaves best developed; cauline leaves usually smaller than basal

42 Stems obviously puberulent; flowers mostly ascending, never drooping; corollas not inflated; floor obscurely ridged; plants 1-3 dm tall; basal rosette persistent; subalpine meadows in wc&cNM (SO San Mateo & Magdalena Mts); 9500-10,100 ft; Jul-Aug (Oct); RARE ..... ***P. pseudoparvus*** Crosswhite

42 Stems obscurely puberulent; flowers drooping to horizontal, never ascending; corollas little inflated; floor moderately ridged; plants 1.5-4 dm tall; basal rosette present or absent at anthesis; meadows & moist woods in wc&ncNM (CA, CI, MC, SA, SO) to ecAZ (White Mts); 8200-11,400 ft; Jun-Aug ..... ***P. oligantlus*** Woot. & Standl.

29 Inflorescence not glandular (glabrous or puberulous)

43 Inflorescence not at all secund; flowers 10-14 mm long, in dense fascicles usually separated by long internodes; slopes, meadows, forests in nNM (CO, RA, SA, SJ, TA), nAZ, wCO, neUT, seWY; 7000-10,800 ft; Jul-Aug (Sep) ..... ***P. rydbergii*** A.Nels.

43 Inflorescence at least somewhat secund, often distinctly so; flowers 15 40 mm long, not in dense fascicles, or if so, the fascicles not separated by long internodes

44 Leaves large & broad, lance ovate or oblong; inflorescence usually broad and compact; corolla 30-40 mm long; stems usually densely leafy; plains & low mountains in neNM (CO, UN) & scCO; 5200-6700 ft; Jun-Aug ..... ***P. glaber*** Pursh var. ***brandegei*** (Porter) Freeman (*P. alpinus* Torr. subsp. *brandegei* (Porter) Harrington)

44 Leaves linear or lanceolate; inflorescence usually narrow and elongated; corolla 15-38 mm long

45 Anthers glabrous, not explanate; staminode hairy or glabrous

46 Staminode with tuft of golden hairs at tip; corolla blue purple, violet purple, occasionally paler, 16-25 mm, base of lower lobes white bearded; sepals 4-9mm; NM (CA, CI), ecAZ (fairly common); 7500-11,280 ft; Jul-Sep; RARE ..... ***P. deaveri*** Crosswhite

(Continued on page 6, Penstemon)

(Penstemon, Continued from page 5)

46 Staminode glabrous

47 Corolla 25-35 mm long, 10-17 mm wide, usually strongly white bearded at base of lower lobes; sepals 4-8 mm long; plants glabrous; NM (LI, OT) endemic to Capitan & Sacramento Mts but not rare; 6000-9000 ft; Jul-Aug ..... ***P. neomexicanus*** Woot. & Standl.

47 Corolla 17-28 mm long, 7-10 mm wide, glabrous or lightly white bearded at base of lower lobes; sepals 2-4 mm long

48 Plants puberulous; mountain valleys & hillsides in nc,wc,swNM (BE, CA, CO, GR, LU, MC, RA, SA, SF, SI, M, TA, TO) & ncAZ; 7000-11,000 ft; Jul-Aug ..... ***P. virgatus*** Gray subsp. ***virgatus***

48 Plants glabrous; uncommon in ncNM (CO) but abundant in Front Range, CO; 5500-9500 ft; Jul ..... ***P. virgatus*** Gray subsp. ***asa-grayii*** Crosswhite

45 Anthers pubescent (sometimes very sparsely), not opening proximal 1/6 1/4, sutures spinescent; staminode glabrous to short bearded

49 Anthers with flexuous hairs < length of sac; staminode short bearded on distal half; calyx 8-10 mm long, segments usually lanceolate, acuminate or caudate, lower margins scarious, erose; corolla pale blue to lavender; nwNM (RA, SJ), seUT, swCO, neAZ; 5500-9200 ft; Jun-Jul ..... ***P. strictiformis*** Rydb. (*P. strictus* Benth. subsp. *strictiformis*)

49 Anthers usually densely villous (sometimes sparsely so) with hairs greater than or equalling the length of the sac; staminode glabrous or with a few hairs at the tip; calyx 3-6 (8) mm long, segments usually ovate, rounded

50 Inflorescence narrow, cymes 1-2 flowered on short, usually appressed peduncles & pedicels; corolla deep blue, 18-32 mm long; anthers less densely pubescent than *P. comarrhenus*, cells not obscured, occasionally very sparse; plains, meadows, wooded slopes in sagebrush, oak, PJ, PIPO & fir in NM (BE, CA, CI, CO, MC, RA, SA, SJ, TA, TO), neAZ, wCO, UT, sWY; 7200-10,500 ft; Jun-Aug ..... ***P. strictus*** Benth.

49 Inflorescence usually broader, cymes often much-branched, peduncles & pedicels elongate & divaricate; corolla pale blue to lavender, 25-38 mm long; sagebrush, PJ, oak, PIPO in nwNM (SJ), swCO, UT, neAZ, NV; 5200-9000 ft; Jun-Aug ..... ***P. comarrhenus*** Gray

PENSTEMONS, THE BEAUTIFUL BEARDTONGUES OF NEW MEXICO

By Jean Heflin with Photographs by Bill Heflin (and others) and Drawings by Robert DeWitt Ivey

[Jack Rabbit Press, 2531 Griegos Pl. NW
Albuquerque, NM 87107-2873; $20+4.50]

Review by **David L. Bleakly**

I imagine everyone likes penstemons, whether you are a botanist or not. Whenever I see even the most common or least showy one I usually smile with pleasure. Clearly Jean and Bill Heflin also love these colorful plants. Their new book, *Penstemons, the Beautiful Beardtongues of New Mexico*, with photographs mostly by Bill Heflin and drawings by DeWitt Ivey, shows their continuing fascination with this genus. In many ways, the book is a color-photo-illustrated version of one that Jean Heflin authored in 1990 (with drawings by Erma Pilz) and much of the text is identical although it is often more complete. In the new one, virtually every taxon is illustrated by three images: color photographs of both the whole plant and of the flowers and a line drawing. The photos are grouped in a center section which interrupts the text and is slightly inconvenient, although I realize it is more economical to print photos this way rather than placing them individually with each species' treatment as the drawings are arranged. The majority of the photos are very good, although a few are poor, usually because they are out of focus, blurry, or have too shallow a depth of field. I take many slides of flowers myself so I know how difficult it is to deal with wind, poor lighting, and shallow depth of field, frequently simultaneously. I usually use an electronic flash, even in daylight, when I take close ups of flowers especially when I use extension tubes to increase magnification. Such a technique would probably have helped to improve some of the closeups in the book. Three other photographers contributed three images, and perhaps more of this type of collaboration could have eliminated missing or poor images. Nevertheless, the majority of the photographs are fine. Many books that use photographs to illustrate plants opt for either a habit shot or a closeup, when both are usually needed. I'm glad to see that the authors did the right thing by including both types of images and as well as drawings.

Even though I love color photographs, I believe that line drawings are the most economical and practical way to illustrate plants. All pertinent features can be depicted in a single, easily and cheaply reproducible plate or image. Nevertheless, color photos can be better at indicating flower color, glaucescence, and the plant's architecture, for example, than drawings or text, so the combination of photos and drawings works well. Color also helps to sell books. It is very likely everyone who will read this review knows of DeWitt Ivey's drawing talent. His images complement the photos nicely, and indeed they could easily stand as the only illustrations, as was done in the earlier book. A helpful addition to the drawings would have been an enlarged illustration of one flower, perhaps a cut away longitudinal section, showing the calyx, position of the corolla lobes, stamens, staminode, and pubescence at the base of the lower lobes (if any), many of the most important features of the genus.

The taxa are arranged alphabetically except for the Oliganthi Alliance, which was created by Crosswhite after he split *P. oliganthus* to include *P. griffithsii*, *P. inflatus*, and *P. psendoparvus*, as well as a more narrowly defined *P. oliganthus*. All of these plants are treated in sequence after *P. oliganthus*. Most of species of the state are included, but there are a few unusual additions, changes, and omissions. A new state record for *Penstemon linarioides compactifolius* is given without verification (no detailed information or specimens cited). The record is from Hidalgo county; otherwise it grows only in the Flagstaff area, as far as I know. *Penstemon metcalfei* is treated as a separate species rather than as a synonym of *P. whippleanus*, which is how it has been considered for the last fifty years. It apparently has not been collected recently (I have seen no

(Continued on page 7, Review)

Botanical Literature of Interest

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Rare, Threatened, and Endangered Plants:

[There are numerous reports and discussions concerning rare New Mexico plants on the New Mexico Rare Plant Technical Council web site: http://biology.unm.edu/~chelo/nmrptc1.html]

Miscellaneous, Agriculture, Ecology, Etc.:

Journals, Newsletters, Etc.:

Native Plant Society of New Mexico Newsletter. Tim McKimmie, 1105 Circle Drive, Las Cruces, NM 88005.

New Mexico Naturalist's Notes. P. Knight & R. Sivinski, eds. Sponsored by Marron & Associates, Inc. 7809 Fourth St. NW, Albuquerque, NM 87107. (505) 898-8848. 🕮

New Plant Distribution Records

New records for New Mexico are documented by the county of occurrence and the disposition (herbarium) of a specimen.

— Stutz & Chu (1997; see literature)
Atriplex pachypoda Stutz & Chu (Chenopodiaceae): Rio Arriba Co. (BRY).

— David Bleakly (3813 Monroe, NE, Albuquerque, NM 87110)
Penstemon comarrhenus Gray (Scrophulariaceae): San Juan Co. (SJN,UNM); Rio Arriba (SJNM).
Penstemon virgatus Gray subsp. ***asa-grayii*** Crosswhite (Scrophulariaceae): Colfax Co. (UNM).
Penstemon cobea Nuttall (Scrophulariaceae): Quay & Taos Cos. (UNM).
Penstemon deaveri Crosswhite (Scrophulariaceae): Catron Co. [fide Crosswhite 1967].

(Review, Continued from page 6)
specimens anywhere). Nevertheless there are two photos identified as this taxon from the Black Range in the book. I believe the jury is still out as to the status of this plant — is it a distinct species or a synonym of *P. whippleanus*? [See the lead article in this issue for a more complete discussion of this problem-ed.] There are two taxa that should have been included. The literature shows that *P. deaveri* is known from Catron county (I have seen no New Mexico specimens). No list or treatment of the genus for the state has ever included *Penstemon virgatus asa-grayii*, as far as I'm aware, although there are specimens from New Mexico at UNM and Crosswhite cites a New Mexico collection in one of his articles.

The text is presented in a more or less standard botanical format including the scientific name (with the authorities); a nomenclatural history with synonyms, and descriptions of habit, flowers, leaves, calyx, stamens, and other information. The technical information presented in Nisbet & Jackson, Pilz & Heflin, and this book is very similar and seems to be mostly derived from Nisbet & Jackson; there appear to be few additions or adjustments to the descriptions in this book based on personal observation or experience. Although the information contained in the species' descriptions is generally adequate, it could be more detailed and complete, particularly for the anthers, which are one of the critical features of the genus. Since the book targets laypersons, the terminology is mostly nontechnical. What is very useful are introductory comments that relate important, easily observed features, blooming time and so on. One thing that is conspicuously missing, from a botanist's point of view, is a key to the species. Despite some shortcomings, it is still a useful book. I like it particularly for its photographs and illustrations and I can recommend it to anyone interested in penstemons or the flora of the state. 🕮

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"The New Mexico Botanist" is published irregularly (as information accrues) at no charge. You may be placed on the mailing list by sending your name and complete mailing address to the editor:

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Kelly W. Allred, Editor

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